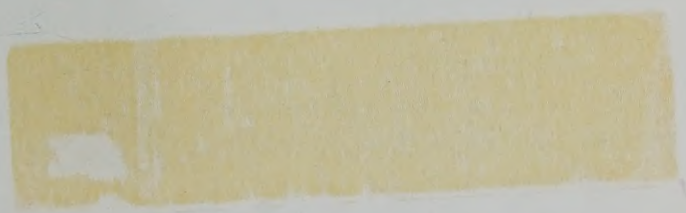
MACHINE TRADES JOBS

AND

JOB SHEETS



Series 100

OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

DIVISION OF VOCATIONAL EDUCATION
STATE DEPARTMENT OF EDUCATION
COLUMBUS, OHIO

University of
Illinois Library
at Urbana-Champaign
Oak Street

Copyright - 1963

Trade and Industrial Education Service
Edited and distributed by the:

Trade and Industrial Education
Instructional Materials Laboratory
The Ohio State University
College of Education
Columbus, Ohio 43210

Reprint - November 1963
Reprint - February 1966
Reprint - June, 1968

Acknowledgment

Training in the machine trades area constitutes a large portion of the Trade and Industrial Education programs in the State of Ohio. Various instructional materials, for both the learner and the instructor, have been provided through the Instructional Materials Laboratory for this trade since 1949.

One specific type of instructional material made available to local machine trade programs in the past were the instructor procedure sheets, including assembly and detail drawings. This teaching aid was prepared and made available over a period of years, especially for instructors in the in-school program. In order to improve the selection of machine trades jobs included in the original set, a committee was organized in 1958 to revise and expand the jobs that would provide a wider and more representative group of operations involved in the new jobs to be made available.

This committee, working under the direction of Merle E. Strong then the Instructional Materials Consultant, consisted of the following machine trades instructors: J. M. Blythe, Zanesville; F. B. Drake, Toledo; C. H. Hites, Lima; E. J. Keener, Warren; D. B. Neimeister, Marion; and C. H. Rensch, Canton. Grateful acknowledgment is extended to these machine trades instructors for their efforts and cooperation in compiling and selecting the revised listing of jobs and job sheets to be included in this new publication.

Acknowledgment is extended to the following staff members of the Trade and Industrial Education Services who reviewed the jobs and job sheets, namely, G. G. McMahon, C. W. Nichols and G. E. Williams, working with William M. Berndt, Instructional Materials Consultant, during 1959 and 1960.

Special mention is also extended to the State-wide Instructional Materials Advisory Committee who over a period of several years provided guidance and made recommendations regarding this teaching aid.

Special commendation is extended to the supervisors and instructors in the various local schools who submitted one or more of their machine trades jobs and job sheets to the selection committee for inclusion in this publication.

Special mention is extended to Elton E. Kistler, Supervisor, Trade and Industrial Education, Norwood, Ohio, for the many jobs which he provided and particularly for his cooperation in making the castings required for certain jobs available to any local program. Mr. Kistler has devoted considerable time and effort in making this teaching aid a successful one. He developed many of the jobs and the patterns for those requiring castings. In addition, he made or had made the matched plates required

for the making all of the castings. Considerable time and effort was devoted by him in dealing with foundries, storing the numerous castings, filling orders, invoicing, and making shipment of castings upon requests from local schools.

Acknowledgment is extended to H. R. Seaman, Supervisor, Trade and Industrial Education, and to R. E. Crabbe, foundry instructor, Springfield, Ohio, for making some of the wood patterns for some of the added jobs which required castings.

Acknowledgment is extended to H. L. Berger, Massillon, Ohio, for his cooperation in providing some of the drawings of certain of the new jobs added to the original set.

Acknowledgment is also extended to C. H. Rensch, Canton, Ohio, for reviewing and checking the drawings and job sheets on all the jobs and developing the job sheets for certain of the jobs.

Grateful acknowledgment for the development of this manual is extended to William M. Berndt, Head of the Instructional Materials Laboratory, Trade and Industrial Education Services, College of Education, The Ohio State University, and to the capable staff of the Laboratory of the composition and production of this manual.

Harry F. Davis, Supervisor
Trade and Industrial Education Services

Contents

Page

ACKNOWLEDGMENT iii
TO THE INSTRUCTOR vi
OPERATIONS CHART ix

Job No.	Name of Job
101	Drill Point Gage
102	Center Gage
103	Tool Bit Gage
104	Double Pointed Scriber
105	Parallels
106	Clamp Strap
107	U Clamp Strap
108	Step Block
109	Drill Press Vise
110	Drill Press Vise
111	V-Block, 4 Inch
112	C Clamp
113	Heavy Service C Clamp
114	Angle Clamp V Block
115	C Clamp (cast iron frame)
116	Parallel Clamp
117	Bench Block
118	Trammel Points
119	Fly-Cutting Adaptor
120	Standard Lathe Mandrel
121	Drill Press Vise
122	Angle Plate
123	Surface Plate
124	Surface Plate

To the Instructor

The two Machine Trades Jobs and Job Sheets manuals, Series 100 and Series 200, have been prepared to assist you, the instructor, in the machine trade, especially in the in-school program. In trade education, students are usually assigned one or more production skills (operations) in the form of jobs, which necessarily are less complex for the beginning student and gradually becoming more complex as the student gains skill and technical knowledge.

The jobs and job sheets contained in the two manuals are of great value to the instructor. They will be of great aid, particularly in starting new students on the more elementary skills at the start of the school year, and will be of great assistance in classes where different levels of instruction are being given at the same time. They will also greatly assist the instructor in facilitating the assigning of work to students throughout the school year.

The references made herein, regarding the use of these job sheets, in no way implies that a student will complete all operations on one particular job as one assignment. In order to develop the desired level of skill on any one operation, the student assignment may well include the performance of only one or a few operations within the total job on a pre-determined number of pieces. This will provide the repetitive practice necessary to develop the required skill by utilizing the production method.

A job sheet, with its accompanying drawings, is a sheet containing the necessary information and instructions for carrying out one of the aforementioned complete trade jobs. It consists of the steps and key points in a procedure upon which the student must place special emphasis to properly complete the job. As such, the job sheet is one of the family of instruction sheets. The job sheet, as used in a training situation, is designed to help the student learn how to perform the operations within the job. Job sheets, complete in all aspects, are a must for all beginning students, but as the student advances the job sheet can gradually assume a simpler and less detailed form. Eventually, it may approach that of a job ticket, work order, or simple shop print.

As stated before, beginning students may work from prepared job sheets, but as soon as practical and when skills and knowledge are gained, students should be required to develop their own job sheets for each job. Later on they may be required to develop only a job plan sheet, after the student has acquired sufficient ability to plan his own work. The student should definitely not be permitted to use the prepared job sheets throughout his learning period. Instructors permitting this to occur would be denying the students the very important experience of planning assignments in a logical and

and sequential order, which is so necessary for success on-the-job. The previous statements cannot be emphasized too strongly.

The prepared detailed job sheet will serve as a check sheet for the instructors use in approving the job plan sheet prepared by the student or when giving oral instructions to the student on a particular assignment.

Some form of job sheet should be prepared by the instructor for each assignment contained in the course of study. A complete set of job sheets (covering the operations and skills to be learned) constitutes the working outline of your course of study. They offer an efficient and practical way of making assignments and are generally used in the trade for the same purpose.

The jobs contained in the Series 100 and Series 200 manuals progress from the simple to the more complex and cover the complete range of basic operations in the machine trade. Each job consists of drawings and job sheets which provide detailed information about the job. The drawings are printed on vellum paper so that blueprints can be made for shop use. The bound copies of these manuals are intended for instructor use only. Individual copies of each job are available packaged in separate envelopes, eliminating the necessity of removing same from the bound copies due to the difficulty of replacing them. The individual copies are recommended for student use or for the purpose of making reproductions for student use, thus permitting the original individual copy to be retained as an original master copy.

The following jobs require castings which are available from our supplier:

MJ-110	MJ-122
MJ-114	MJ-123
MJ-115	MJ-124
MJ-121	
MJ-211	MJ-218
MJ-212	MJ-221
MJ-213	MJ-224
MJ-215	MJ-225
MJ-216	MJ-226

The Series 200 jobs make excellent advanced production type jobs. Request information for purchasing the castings required in the above listed jobs by writing to: Consultant, Instructional Materials Laboratory, 1885 Neil Ave., Columbus 10, Ohio.

The following jobs require round or square (bar stock) castings, but our supplier cannot furnish them:

MJ-108	MJ-111

These can be secured through a local foundry or made in your school foundry.

Prior to assigning a job which requires the use of castings, it is suggested that the drawings be studied carefully before starting the job to make certain that dimensions and related parts of the job will work-out properly. This precaution should be taken to avoid ruining the castings.

Only the drawings are provided for the following jobs, job sheets are not included:

MJ-115	MJ-123
MJ-121	MJ-124
MJ-122	
MJ-212	MJ-225
MJ-224	MJ-226

The following page contains an Operations Chart for the particular set of jobs contained in this manual. It indicates the operations which are included in each job and will assist the instructor in selecting the most suitable job to meet the needs of an individual student, thus providing the student a well-rounded training in the variety and frequency of operations leading to success on-the-job. Many operations may be performed on more than one machine, depending on the machines available in the shop or by preference of the instructor and/or student for the purpose of learning a specific type of operation. It is realized that each instructor may not completely agree with the operations as specified in the Operations Chart, due again to personal preference and to equipment available. Please note that there are additional spaces on the Operations Chart for you to add some of your own jobs and also space provided to add additional operations under each of the major headings of machine shop work.

It is suggested that both the job sheets and drawings to be used by students in the shop should be protected by some suitable means, such as, mounting on cardboard or sheet metal and a protective coating applied or placed in a cellophane or vinyl envelope.

JOB NUMBER	N
101	DRILL POIN
102	CENTER GA
103	TOOL BIT G
104	DOUBLE PO
105	PARALLELS
106	CLAMP STR
107	U-CLAMP ST
108	STEP BLOC
109	DRILL PRES
110	DRILL PRES
111	V-BLOCK, 4
112	C-CLAMP
113	C-CLAMP, H
114	ANGLE CLA
115	C-CLAMP (C
116	PARALLEL
117	BENCH BLO
118	TRAMMEL P
119	FLY-CUTTI
120	STANDARD
121	DRILL PRES
122	ANGLE PLA
123	SURFACE P
124	SURFACE P

OPERATIONS CHART — 100 SERIES JOBS

| JOB NUMBER | NAME OF JOB | BENCH WORK: LAYOUT | INSPECTION | HACK SAWING | FILING | TAPPING | DIE THREADING | HAND POLISHING | MICROMETER | PROTRACTOR | SCRAPING | DRILLING MACHINE WORK: STRAIGHT DRILLING | CENTER DRILLING | COUNTERSINKING | SPOTFACING | COUNTERBORING | TAPPING | REAMING | ENGINE LATHE WORK: STRAIGHT TURNING | SHOULDER TURNING | TAPER TURNING | FORM TURNING | ANGULAR TURNING | FACING IN CHUCK | FACING BETWEEN CENTER | NECKING OR GROOVING | CHUCKING | DRILLING | CENTER DRILLING | CUTTING-OFF | REAMING | BORING | TAPER BORING | CHAMFERING | FILING | POLISHING | RADIUS OR FILLET TURNING | CUTTING INTERNAL THREADS | CUTTING EXTERNAL THREADS | GRINDING | KNURLING | TAPPING | POWER SAW WORK: CUT-OFF: STRAIGHT CUTTING | ANGULAR CUTTING | BAND: STRAIGHT CUTTING | CONTOUR CUTTING | FILING | SHAPER WORK: HORIZONTAL SHAPING | VERTICAL SHAPING | ANGULAR SHAPING | FORM SHAPING | GROOVE SHAPING | KEYWAY SHAPING | MILLING MACHINE WORK: HORIZONTAL SURFACE MILLING | VERTICAL SURFACE MILLING | ANGULAR MILLING | SLOTTING | SAWING | BORING | REAMING | DRILLING | INDEXING | GRINDER WORK: BENCH: SHARPENING TOOLS | SHAGGING | SURFACE: SURFACE GRINDING | STEP GRINDING | CYL.: STRAIGHT GRINDING | TAPER GRINDING | HEAT TREATING WORK: HARDENING | TEMPERING | CASE HARDENING | TESTING HARDNESS | JOB NUMBER |
|---|---|---

DRILL POINT GAGE

INTRODUCTORY INFORMATION:

This tool is an essential and convenient one to use when grinding twist drills. There are several styles and shapes of gages of this type, but the simplicity of this one was a deciding factor in its selection. The graduations along the angular edge enables the trainee to check the sides of the drill and determine the correct position of the point. However, the graduations may be omitted if desired and the tool still serves its intended purpose.

STOCK:

16 Ga. (.0598) x 1-11/16" x 5-1/16" C.R.S.

SAFETY AND PRECAUTIONS:

1. Make sure angles are laid out correctly.
2. Check piece for warpage after case hardening.
3. Observe all shop safety rules.

Drill Point Gage

STOCK:

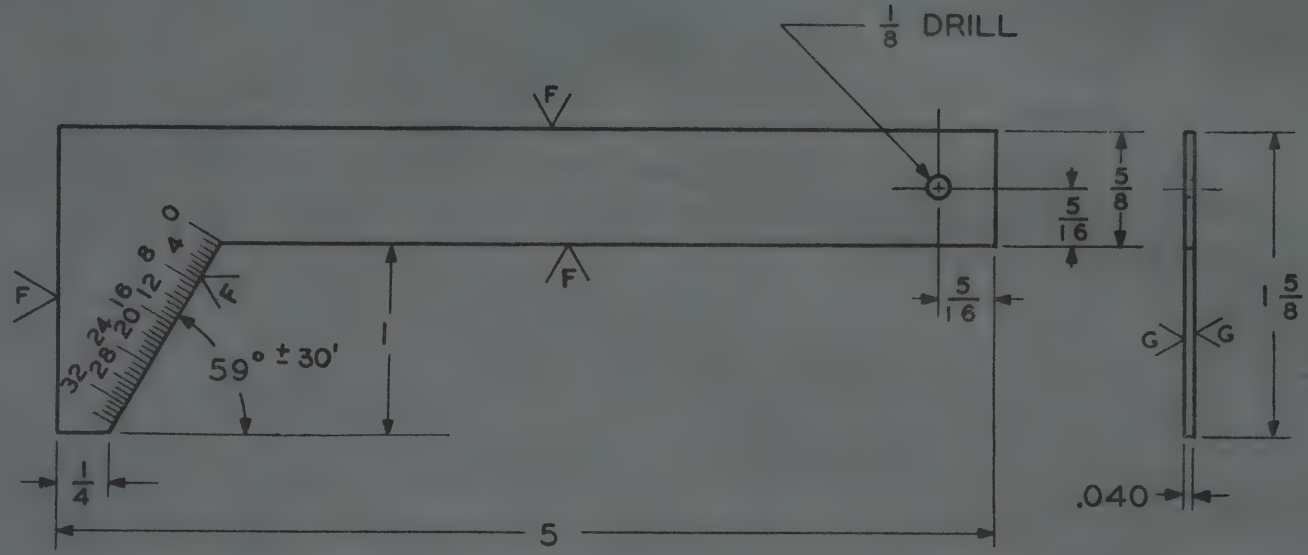
C.R.S.

TOOLS:

6" Steel rule	1/8" Drill	1" Micrometer
Scriber	10" Mill file	Center punch
Bevel protractor	Triangular stone	Square
Hammer	Layout dye	Hacksaw

PROCEDURES OR STEPS:

1. Cut off C.R.S. 1/16" x 1-11/16", 5-1/16" long.
2. Lay off as per drawing.
3. Drill 1/8" hole.
4. Saw approximately 1/64" on the outside of lines.
5. File to lines.
6. Clamp piece on holding fixture and cut graduations approximately .020" deep.
7. Remove all burrs, break all sharp edges.
8. Case harden.
9. Check piece for warpage and straighten if necessary.
10. Stone edges with triangular stone holding 59° angle.
11. Inspect 100% as per drawing.



NOTE:

BREAK SHARP EDGES

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.R.S.	PART NAME: DRILL POINT GAGE	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT: CASE HARDEN	NO. REQD. 1	SCALE: FULL / SHEET 1 OF 1
		USED ON	DWG. NO. 101 A 1

NOTE:

BREAK SHARP EDGES

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

MATERIAL	PART NAME	NO REQD. 1	SCALE: FULL	SHEET 1 OF 1
C.R.S.				
HEAT TREAT CASE HARDEN				DWG. NO. 101 A 1

DO NOT SCALE THIS DRAWING

DRILL POINT GAGE

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003 OF CENTER LINE CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.005; ANGULAR 2°

CENTER GAGE

INTRODUCTORY INFORMATION:

This gage is used in grinding and setting thread-cutting tools. Its design is simple but effective and the tool serves a very definite and practical purpose. It is another of those essentials in the machinist's tool box. It may be case hardened and polished or semi-finished as desired.

STOCK:

16 Ga. (.0598) x 1" x 2-5/16" C. R. steel.

SAFETY AND PRECAUTIONS:

1. Make sure angles are correct when laying off piece.
2. Make sure piece is straight after hardening.
3. Observe all shop safety rules.

Center Gage

STOCK:

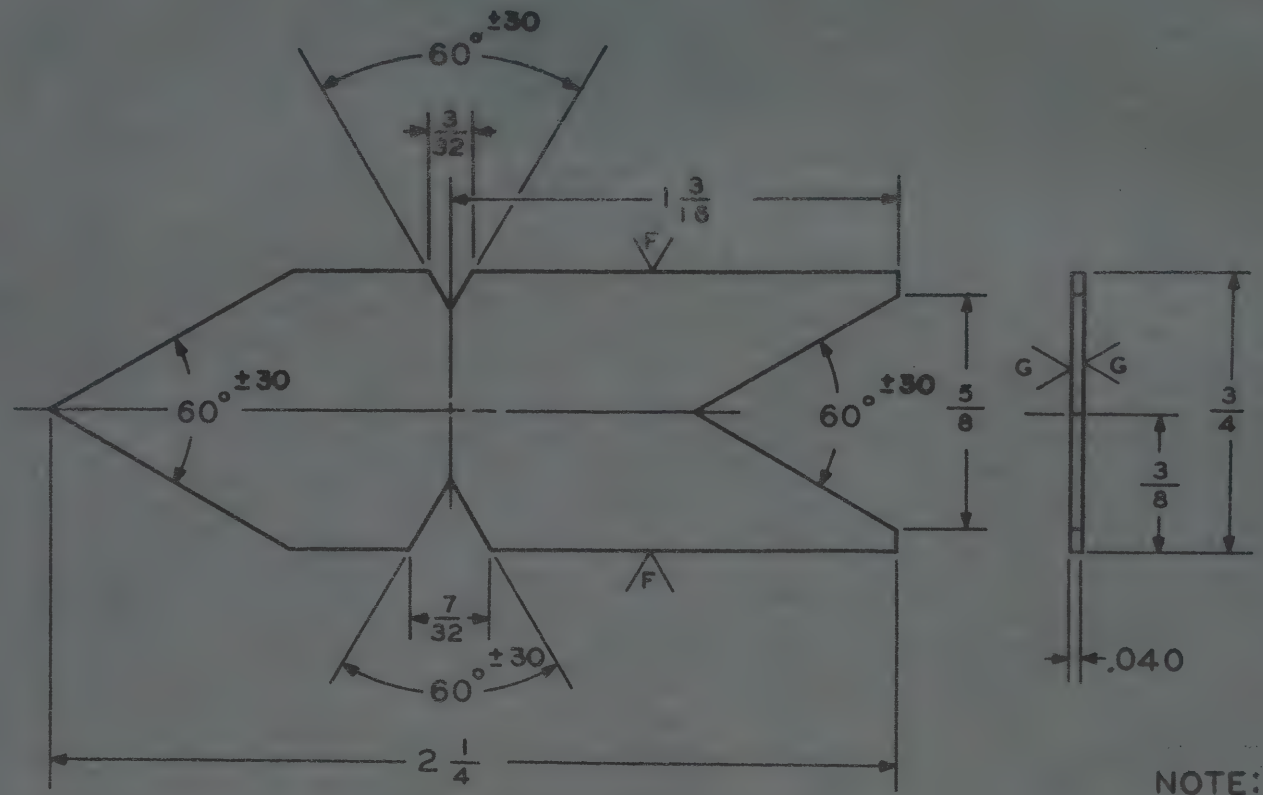
C. R. S.

TOOLS:

6" Steel rule	Scriber	1" Micrometer
Center gage	10" Mill file	Triangular stone
Bevel protractor	60 Degree V-file	Layout dye
	Hacksaw	

PROCEDURES OR STEPS:

1. Cut off 16 Ga. x 1" C. R. S., 2-5/16" long.
2. Lay out center lines - lightly.
3. Lay out angles as per drawing quite heavily.
4. Saw approximately 1/64" on outside of lines.
5. Finish file to lines, use 10" mill file.
6. Carburize and harden.
7. Straighten piece in case of warpage in heat treating.
8. Hold piece on magnetic chuck on surface grinder, grind .010" off one side, use sufficient coolant to prevent piece from warping.
9. Turn piece over, grind other side to .040" thickness as per drawing.
10. Stone edges of all 60^{o} angles with a triangular stone to fit 60^{o} angle center gage.
11. Inspect 100% as per drawing.



NOTE:

STONE ALL 60° ANGLES

BREAK SHARP EDGES

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.R.S.	PART NAME: CENTER GAGE	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT: CARBURIZE & HARDEN	NO. REQD 1	SCALE: 2 TO 1 / SHEET 1 OF 1
		USED ON	DWG. NO. 102 A 1

NOTE:
STONE ALL 60°
ANGLES
BREAK SHARP
EDGES

DO NOT SCALE THIS DRAWING

	CENTER CAGE	PART NAME	MATERIAL C.R.S.		
		NO. REQ'D 1	HEAT TREAT CARBURIZE & HARDEN		
		SCALE: 2 TO 1	SHEET 1 OF 1		
		DWG. NO. 102 A1	USED ON		

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN DECIMALS ± .001
TRUE CENTERS WITHIN ± .003 OF CENTER DISTANCE; ANGULARITY ± .001
DIMENSIONAL TOLERANCES: FRACTIONAL ± 1/64; DECIMAL ± .01; ANGULAR ± 1°

TOOL BIT GAGE

INTRODUCTORY INFORMATION:

This tool bit gage is a combination tool which serves the purpose for accurately grinding of front and side clearance on lathe tool bits. This gage is also used to enable on to accurately grind a 55^{o} facing tool, a 60^{o} threading tool and an offset 10^{o} facing tool. To accurately grind a specific tool a tool bit gage is a must.

STOCK:

15 Ga. (.0673") x 2-1/2" x 2-1/2" C. R. S.

SAFETY AND PRECAUTIONS:

1. Exert utmost caution when laying off angles and when stamping or engravin the degrees and letters.
2. Make sure piece is straight after case hardening and before grinding the two sides.
3. Use sufficient coolant to prevent warping when grinding sides.
4. Observe all shop safety rules.

Tool Bit Gage

STOCK:

C.R.S.

TOOLS:

6" Steel rule	Prick punch	3" Dividers
6" Cant file	3/16" Drill	1" Micrometer
Triangular stone	Flat mill file	Scriber
Bevelprotractor	Hacksaw	Number stamps

PROCEDURES OR STEPS:

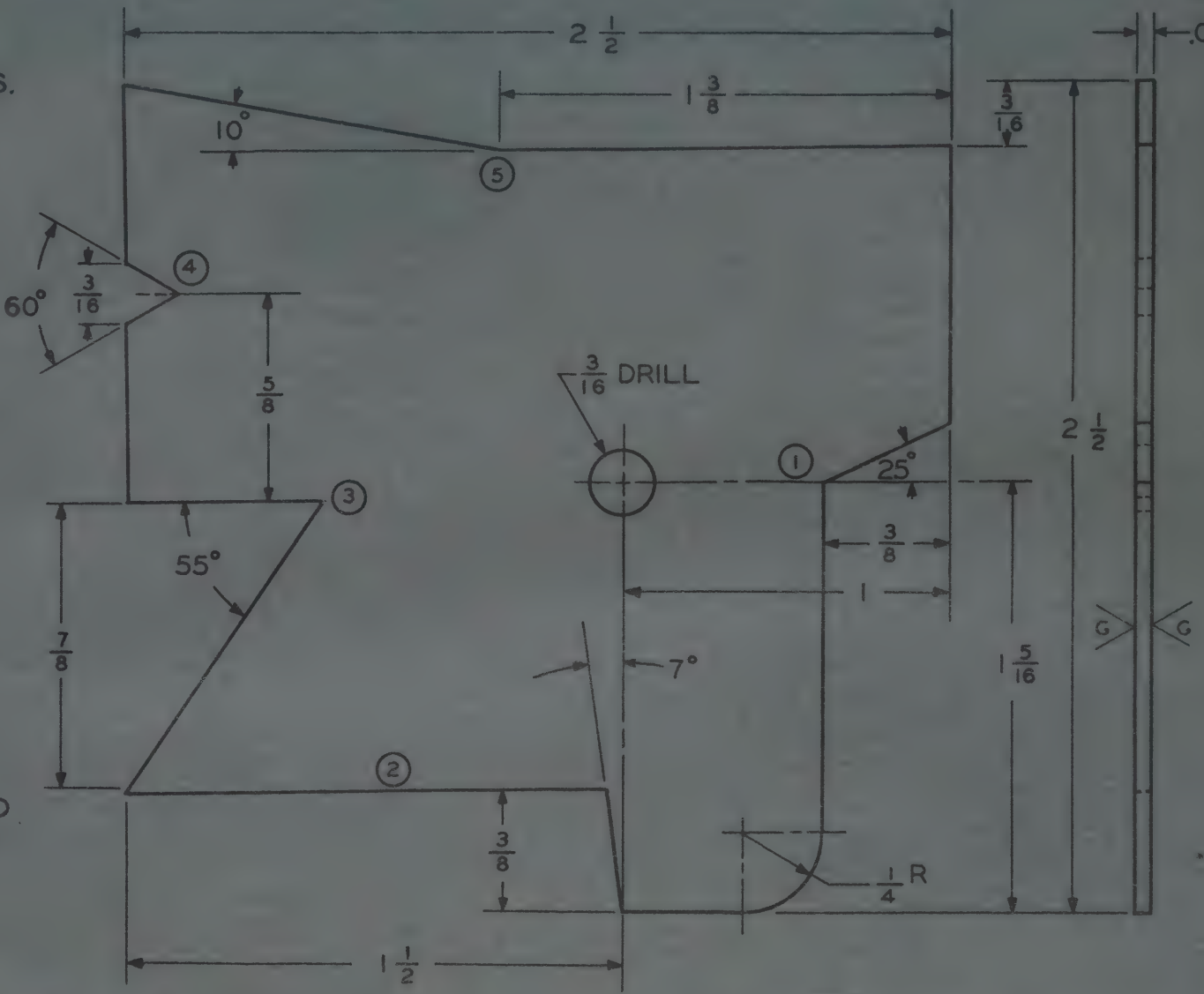
1. Cut off 15 Ga. (.0673") x 2-1/2" x 2-1/2" C. R. S.
2. Lay out as per drawing.
3. Drill 3/16" hole.
4. Saw approximately 1/64" on outside of lines.
5. Finish file to lines.
6. Stamp all degrees and lettering.
7. Break all sharp edges and remove all burrs.
8. Straighten if necessary.
9. Carburize and harden.
10. Straighten if necessary.
11. Grind side with lettering to clean up.
12. Grind other side holding .048" thickness.
13. Stone all finished edges of angles.
14. Inspect 100% as per drawing.

NOTE:
STONE ALL ANGLES.
BREAK SHARP EDGES.
FINISH ALL OVER.

NOTE:
USING LETTERING HEIGHT OF $\frac{1}{16}$ AND AT $\frac{3}{32}$ FROM ANY EDGE, STAMP OR ENGRAVE FOLLOWING FIGURES AND LETTERS. (CIRCLED NUMBERS ONLY SHOW THEIR APPROXIMATE LOCATIONS)

① 25° FRONT CLEARANCE
② 7° SIDE CLEARANCE
③ FACING 55° TOOL
④ 60° THREAD TOOL
⑤ OFFSET 10° FACING TOOL

NOTE:
ONLY DEGREES ARE TO BE STAMPED ON BACK OF GAGE



ALL ANGULAR TOLERANCES ±30'

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.R.S.	PART NAME: TOOL BIT GAGE	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT: CARBURIZE & HARDEN	NO. REQD. 1	SCALE: 2:1
		USED ON	DWG. NO. 103 A 1

NOTE:
STONE ALL ANGLES.
BREAK SHARP EDGES.
FINISH ALL OVER.

NOTE:
USING LETTERING HEIGHT OF 1/16 AND AT 3/32 FROM ANY EDGE, STAMP OR ENGRAVE FOLLOWING FIGURES AND LETTERS. (CIRCLED NUMBERS ONLY SHOW THEIR APPROXIMATE LOCATIONS)

① 25° FRONT CLEARANCE
② 7° SIDE CLEARANCE
③ FACING 55° TOOL
④ 60° THREAD TOOL
⑤ OFFSET 10° FACING TOOL

NOTE:
ONLY DEGREES ARE TO BE STAMPED ON BACK OF CAGE

ALL ANGULAR TOLERANCES ± 30'

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

MATERIAL	PART NAME	DO NOT SCALE THIS DRAWING
C.R.S.	TOOL BIT CAGE	
HEAT TREAT CASEHARDEN & HARDEN	NO. REQD. 1	SCALE: 2:1
USED ON		DWG. NO. 103 A

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.03; ANGULAR 2°

DOUBLE POINTED SCRIBER

INTRODUCTORY INFORMATION:

The scriber is one of the "must have tools" in any machinist tool kit. This particular one is of simple design and offers the learner hard grinding practice, heating and bending, hardening and drawing of tool steel.

STOCK:

3/16" square oil hardening tool steel 8-7/8" long.

SAFETY AND PRECAUTIONS:

1. Always wear eye protection when grinding.
2. Keep sleeves rolled up when operating machines.
3. Always wear heavy leather or asbestos gloves when working with hot metal.
4. Observe all shop safety rules.

Double Pointed Scriber

STOCK:

T.S.

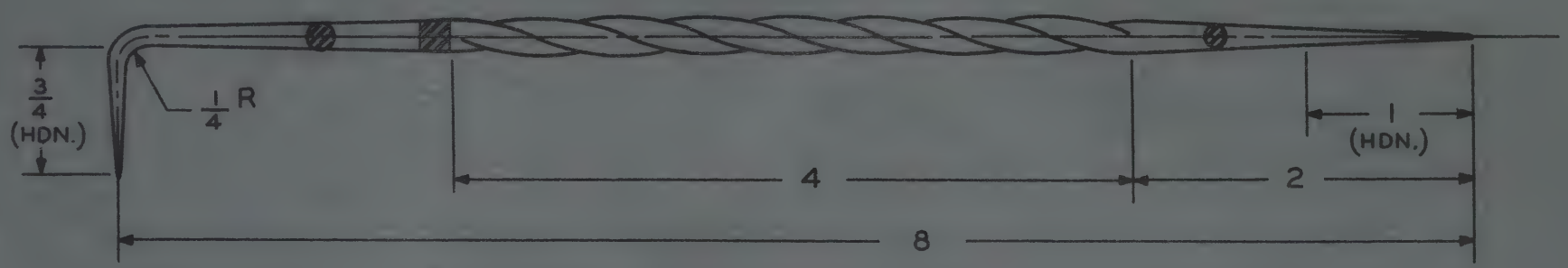
TOOLS:

12" Steel rule
Monkey wrench
Bench or pedestal grinder
Gas torch or furnace

PROCEDURES OR STEPS:

1. Cut off 3/16" square ail hardening tool steel 8-7/8" long.
2. Lay off length of point on each end as per drawing.
3. Heat the 4" section to be twisted to approximately cherry red.
4. Hold one end in bench vise, use monkey wrench, twist handle as per drawing.
5. Grind point on one end.
6. Grind point on other end.'
7. Heat long end to cherry red, approximately 1450^{O}, bend 3/4" hook on long end.
8. Heat entire piece to cherry red, approximately 1450^{O}, quench in oil.
9. Polish length of points on both ends.
10. Heat center of handle and draw to straw color on both points.
11. Inspect 100% as per drawing.

If desired, a sleeve of proper length may be made from a piece of 1/8" pipe and inserted over the stock to keep the handle straight when making the twist. Small sizes of steel may be twisted without heating.



DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	SCRIBER, DOUBLE POINTED	
	T. S.			
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD. 1	SCALE: FULL	SHEET 1 OF 1
	HARDEN & TEMPER	USED ON		DWG. NO. 104 A 1

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE		MATERIAL	SCRIBER, DOUBLE POINTED		
		HEAT TREAT	PART NAME		
UNLESS OTHERWISE SPECIFIED : TRUE CENTERS WITHIN ±.003 OF CENTER RATIO ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.005; ANGULAR 2°		HARDEN & TEMPER	NO. REQD. 1	SCALE: FULL	SHEET 1 OF 1
		USED ON	DWG. NO. 104 A		

PARALLELS

INTRODUCTORY INFORMATION:

Parallels are necessary for supporting work in vises when machining and also used on bench layout work. Parallels should not be bent or damaged and are as essential to a good mechanic as a pair of micrometers.

STOCK:

The material should be oil or water hardening tool steel and size selected from the drawing and chart.

SAFETY AND PRECAUTIONS:

1. Clamp work tight in drill press vise while drilling.
2. Follow dimensions on drawing and chart.
3. Allow material for grinding all over.
4. Grind in pairs.
5. Wear eye protection.
6. Observe all shop safety safety rules.

Parallels

STOCK:

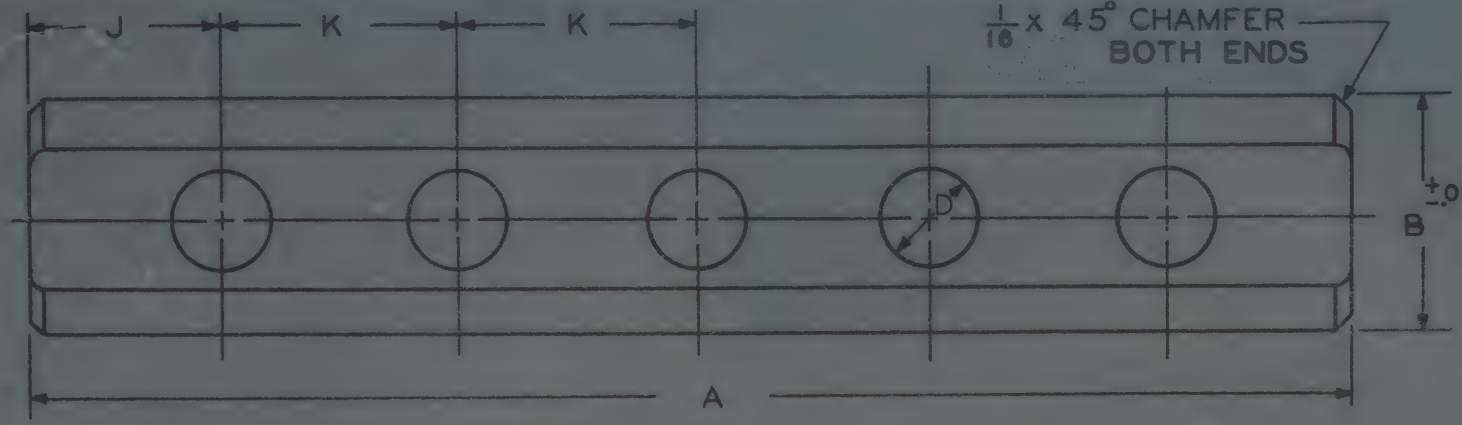
T.S.

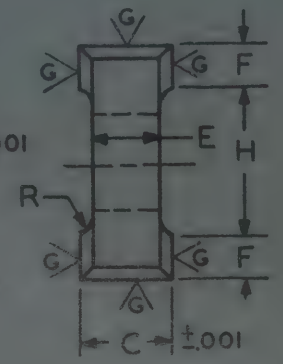
TOOLS:

6" Steel rule	Center punch	1" Micrometer
12" Steel rule	Hammer	2" Micrometer
10" Mill file	Square	Center drill
Layout dye	Shaper tools	Drills as listed on chart
Scriber		

PROCEDURES OR STEPS:

1. Select stock from chart and drawing size.
2. Saw to length, plus 1/8".
3. Lay out for shaper.
4. Shape to drawing size plus .010" on all sides.
5. Layout for drilling.
6. Drill holes as per drawing size.
7. Burr holes and file sharp edges.
8. Inspect 100% according to drawing.
9. Harden and draw temper.
10. Grind to desired chart sizes.





REF. NO.	STOCK			OTHER DIMENSIONS						
	A	B	C	D	E	F	H	J	K	R
1	4	1/2	3/8	—	1/4	1/8	1/4	—	—	1/16
2	4 1/2	5/8	3/8	—	1/4	3/16	1/4	—	—	1/16
3	5	3/4	3/8	—	1/4	3/16	3/8	—	—	1/16
4	5 1/2	7/8	3/8	—	1/4	3/16	1/2	—	—	1/16
5	6	1	1/2	—	3/8	1/4	1/2	—	—	1/16
6	6 1/2	1 1/8	1/2	3/8	3/8	1/4	5/8	1	1 1/8	1/16
7	7	1 1/4	1/2	1/2	3/8	1/4	3/4	1	1 1/4	1/16
8	8	1 1/2	3/4	5/8	1/2	5/16	7/8	1 1/4	1 3/8	1/8
9	9	1 3/4	3/4	3/4	1/2	3/8	1	1 1/4	1 5/8	1/8
10	10	2	3/4	3/4	1/2	7/16	1 1/8	1 1/2	1 3/4	1/8

NOTE:
ALLOW .010, EACH SURFACE, FOR GRINDING

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

MATERIAL	PART NAME	PARALLELS	
TOOL STEEL			
HEAT TREAT	NO. REQD. 2	SCALE: FULL	SHEET 1 OF 1
HARDEN & TEMP.	USED ON		DWG. NO. 105 A 1

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

REF. NO.	STOCK		OTHER DIMENSIONS						
	A	B	C	D	E	F	H	J	K	R
1	4	1 5/8	3/8	—	1/4	1/8	1/4	—	—	1/16
2	4 1/2	2 5/8	3/8	—	1/4	3/16	1/4	—	—	1/16
3	5	3 1/4	3/8	—	1/4	3/16	3/8	—	—	1/16
4	5 1/2	1 7/8	3/8	—	1/4	3/16	1/2	—	—	1/16
5	6	—	1/2	—	3/8	1/4	1/2	—	—	1/16
6	6 1/2	1 1/8	1/2	3/8	3/8	1/4	5/8	—	1 1/8	1/16
7	7	1 1/4	1/2	3/8	3/8	1/4	3/4	—	1 1/4	1/16
8	8	1 1/2	3/4	1/2	1/2	3/8	7/8	1/4	1 3/8	1/8
9	9	1 3/4	3/4	1/2	1/2	3/8	1	1/4	1 5/8	1/8
10	10	2	3/4	1/4	1/2	1/8	1 1/8	1/2	1 3/4	1/8

NOTE:
ALLOW .010" EACH
SURFACE, FOR
GRINDING

DO NOT SCALE THIS DRAWING

MATERIAL	PARTS		
TOOL STEEL	NAME		
HEAT TREAT	NO. REQ'D. 2	SCALE: FULL	SHEET 1 OF 1
HARDEN @ TEMP.	USED ON	DWG. NO. 105 A	

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

CLAMP STRAP

INTRODUCTORY INFORMATION:

Clamp straps are designed in various shapes and sizes, for different types of clamping requirements. This particular clamp is of simple design and very easy to make. It is generally used on the milling machine, planer, and radial drill for clamping work in position.

STOCK:

1/2" x 2" x 4-3/4" C.R.S.

SAFETY AND PRECAUTIONS:

1. Keep sleeves rolled at all times when operating machines.
2. Always be sure tools are sharp and in good condition.
3. Never lay measuring tools on machine.
4. Keep chips from accumulating around machine and on floor.
5. Always lubricate machines before starting.
6. Wear eye protection at all times.
7. Observe all shop safety rules.

Clamp Strap

STOCK:

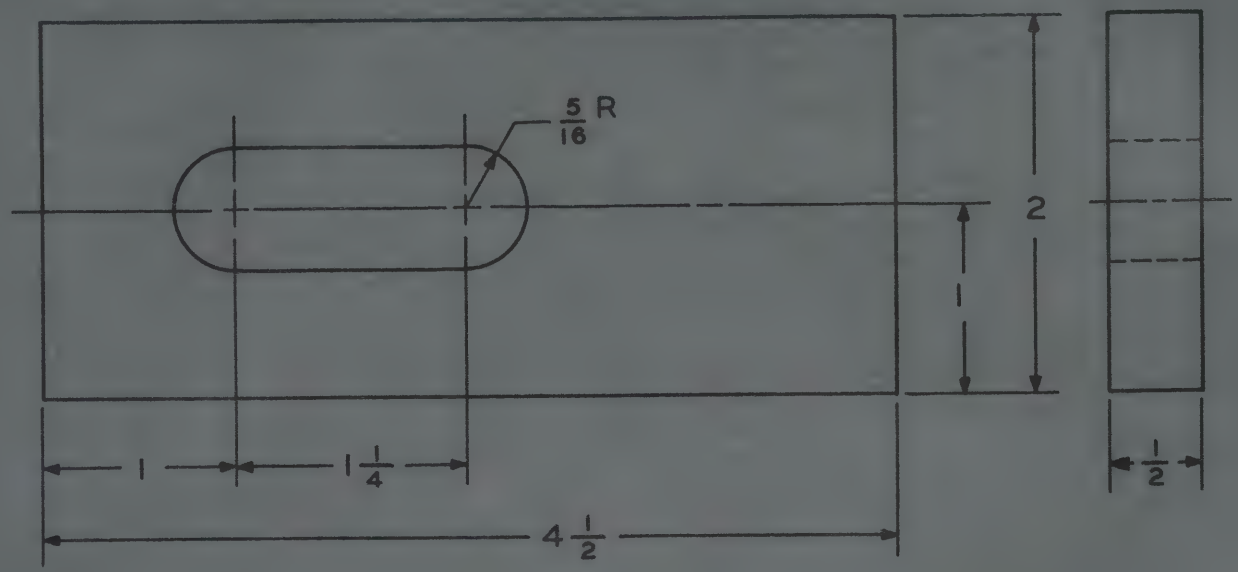
C. R. S.

TOOLS:

6" Rule	Center punch	Scriber
Fine mill file	Ball peen hammer	Combination square set
Dividers	5/8" Drill	5/8" End mill

PROCEDURES OR STEPS:

1. Saw off 1/2" x 2" x 4-5/8" long C. R. S.
2. Square ends to 4-1/2" length.
3. Lay out as per drawing.
4. Center punch for drilled holes.
5. Clamp piece in drill press vise using parallels.
6. Start holes with center drill.
7. Drill two 5/8" holes as per layout.
8. Use 5/8" end mill to mill slot between holes.
9. File off all sharp edges.
10. Inspect 100% as per drawing.



NOTE:

BREAK ALL SHARP EDGES
FINISH ALL OVER

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.R.S.	PART NAME: CLAMP STRAP	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD 1	SCALE: FULL / SHEET 1 OF 1
		USED ON	DWG. NO. 106 A 1

NOTE:

BREAK ALL SHARP EDGES
FINISH ALL OVER

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

MATERIAL	HEAT TREAT	PART NAME	NO. REQD	SCALE: FULL	SHEET 1 OF 1
C.R.S.		CLAMP STRAP	1		

DO NOT SCALE THIS DRAWING

DWG. NO 108 A 1

USED ON

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES : FRACTIONAL ±1/64 ; DECIMAL ±.003 ; ANGULAR 2°

U CLAMP STRAP

INTRODUCTORY INFORMATION:

The U clamp strap is somewhat similar to the clamp strap. Its greater flexibility of usefulness is suggested by its name and the design of the object. This particular clamp is a simple design and easy to make. A quantity of U clamp straps can be very useful in any machine shop. The simple design of this clamp suggests that it can be a bench job and it offers excellent filing practice.

STOCK:

5/8" x 1-5/8" x 4-5/16" C. R. S.

SAFETY AND PRECAUTIONS:

1. Follow all shop safety rules.
2. Check all tools for sharpness.

U Clamp Strap

STOCK:

C. R. S.

TOOLS:

6" Rule	12" Fine mill file	Scriber
3" Dividers	Hand hacksaw	Center punch
12" Flat bastard file	E-2 Center drill	Smooth half-round file
	5/8" Drill	

PROCEDURES OR STEPS:

1. Cut off 5/8" x 1-5/8" x 4-5/16" long, C. R. S. on the power hacksaw.

2. Lay off as per drawing. Center punch for drilling.

3. Hold piece in machine vise on drill press table, center drill with an E-2 center drill, then drill 5/8" hole as per drawing.

4. Saw 5/8" slot to break into 5/8" drilled hole on the contour saw if one is available; otherwise use a hand hacksaw.

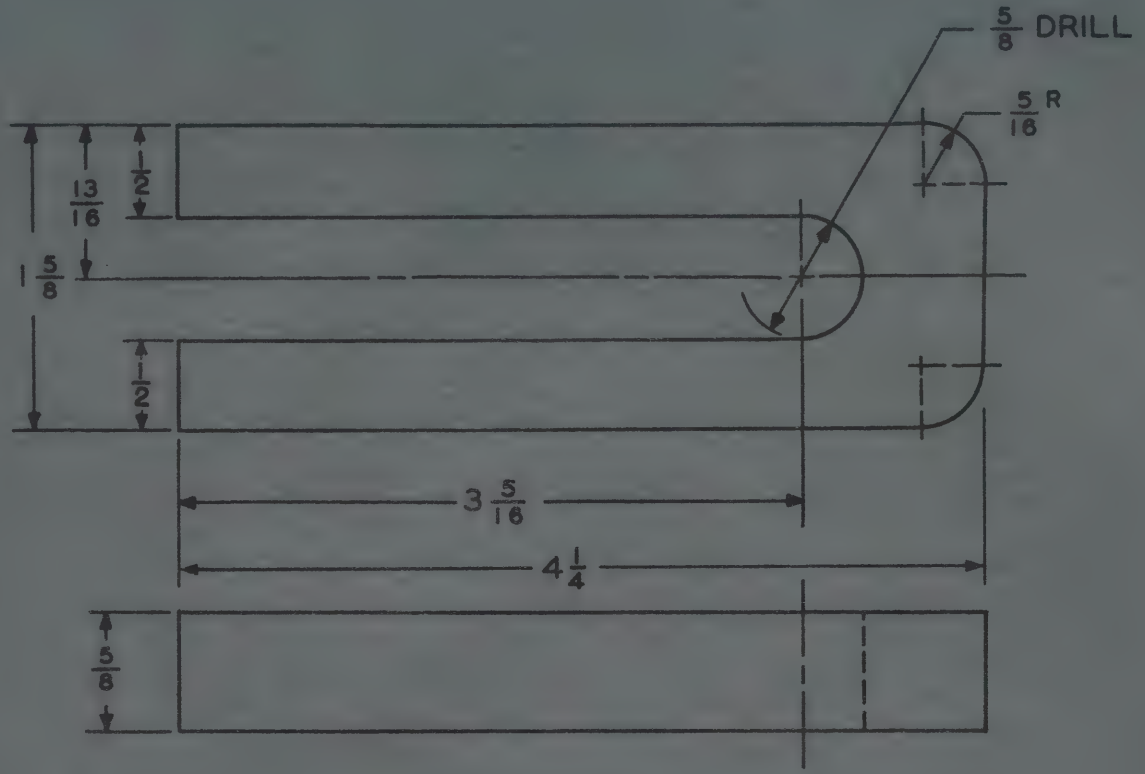
5. Hold piece in bench vise, use flat bastard file and rough file to lines.

6. Hold piece in bench vise with soft jaws, use flat mill file and draw file all surfaces to a smooth finish.

7. Use smooth half round file and break all sharp edges.

8. Inspect 100% as per drawing.

9. Carburize and harden. Note carbon to penetrate C. R. S. to approximately 1/32" depth.



NOTE:

BREAK SHARP CORNERS
FINISH ALL OVER

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL C. R. S.	PART NAME	U-CLAMP STRAP
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT CARBURIZE & HARDEN	NO. REQD. 1 / SCALE: FULL / SHEET 1 OF 1	
		USED ON	DWG. NO. 107 A 1

NOTE:

BREAK SHARP CORNERS
FINISH ALL OVER

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

MATERIAL	PART NAME	U-CLAMP STRAP
C. R. S.		
HEAT TREAT CARBURIZE	NO. REQD.	SCALE: FULL
BY HARDEN	USED ON	DWG. NO. 107 A

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.03; ANGULAR 2°

STEP BLOCK

INTRODUCTORY INFORMATION:

Step blocks are used primarily to shim or build up under strap clamps. The steps on this particular block vary on each face of the block, giving various combinations in height. This block, being simple in design, makes it an excellent milling machine job for the trainee. It is common practice to make step blocks in pairs.

STOCK:

2-1/8" x 4-1/8" x 6-1/8" cast iron.

SAFETY AND PRECAUTIONS:

1. Keep sleeves rolled up when operating machines.
2. Oil machines daily before starting.
3. Never allow chips to accumulate on or around machines
4. Be sure tools are sharp and in good working condition.
5. Follow all shop safety rules.

Step Block

STOCK:

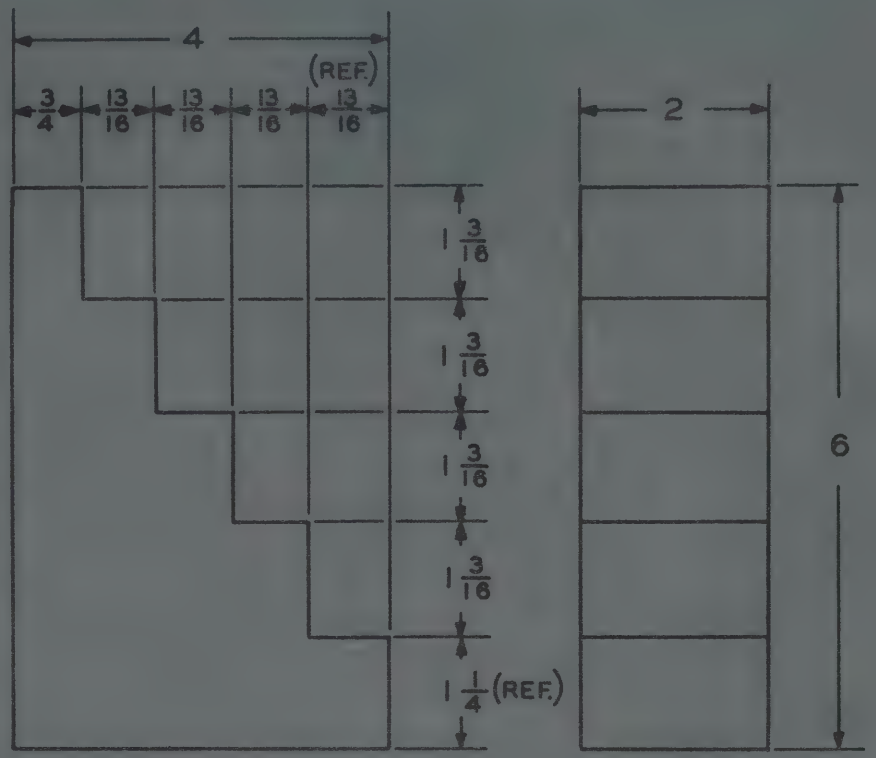
Cast iron

TOOLS:

6" Steel rule	1-1/4" Dia. end mill	Combination square set
4-1/4" Dia. shell end mill	Scriber	Fine flat mill file

PROCEDURES OR STEPS:

1. Saw off 2-1/8" x 4-1/8" x 6-1/8" cast iron in power saw.
2. Clamp piece in machine vise and mill 4" x 6" surface.
3. Hold machined surface against solid vise jaw and mill 1/16" off adjoining surface.
4. Lay out lines 2" and 4" for width and thickness on two surfaces just milled.
5. Roll piece in vise and mill to lines and the 2" wide x 4" thickness.
6. Place in vise one end up and square from one side, mill 1/16" off one end.
7. Lay off to 6" length, square up in vise and mill to 6" length on opposite end.
8. Cover one face with blue dye.
9. Lay out steps as per drawing.
10. Hold in mill vise and mill to layout lines.
11. File all sharp edges.
12. Inspect as per drawing.



NOTE:

BREAK SHARP EDGES.
FINISH ALL OVER.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C. 1.	PART NAME: STEP BLOCK	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT:	NO. REQD. 2	SCALE: HALF / SHEET 1 OF 1
		USED ON	DWG. NO. 108 A 1

NOTE:
BREAK SHARP EDGES.
FINISH ALL OVER.

DIMENSIONS ARE IN INCHES; TOLERANCES: FRACTIONS ±1/64; DECIMALS ±.03; ANGLES ±2°			USED ON		DWG. NO.
UNLESS OTHERWISE SPECIFIED:			NO. REQ'D. 5	SCALE: HALF	SHEET 1 OF 1
TOOL MARKINGS WITHIN ±.005 TO BE CONSIDERED FLAT. CONCENTRIC WITH CENTER HOLE TO BE WITHIN ±.005 TIR.			NAME	DATE	
THE OHIO INDUSTRIAL EQUIPMENT SERVICE			MATERIAL C.I.	HEAT TREAT	
	STEP BLOCK				
DO NOT SCALE THIS DRAWING					

DRILL PRESS VISE

INTRODUCTORY INFORMATION:

This is a useful and well designed vise for holding small work on a drill press. The round bars hold the jaws in alignment. The top and the two sides can be used without removing the work, and drills can pass through the work without drilling into the vise base.

STOCK:

Cold rolled steel is used for all parts except two T.S. insert jaws.

ASSEMBLY PRECAUTIONS:

1. Make sure the 5/8" reamed holes line up in Item #1 - Solid Jaw with Item #3 - Movable Jaw, and Item #9 - Rear Support.

2. The 1/2" screw hole in Item #9 - Rear Support must line up with the 3/8" drilled hole in Item #3 - Movable Jaw.

SAFETY AND PRECAUTIONS:

1. Clamp all work securely in machine vise.

2. File off all sharp corners.

3. Wear eye protection.

4. Observe all shop safety rules.

Item 1 - Solid Jaw

STOCK:

C.R.S. or Machine Steel

TOOLS:

Combination square	#9 Drill	3/8" Drill
Scriber	5/16" Counterbore	39/64"Drill
Center punch	#7 Drill	5/8" Machine reamer
Hammer	1/4" - 20 NC Tap	Layout dye

PROCEDURES OR STEPS:

1. Secure C.R.S. or machine steel 3/4" x 1-5/8" x 2-5/8".
2. Machine 1/16" off of 1-1/2" x 2-1/2" surface.
3. Machine 1/16" off of 5/8" x 1-1/2" adjacent surface.
4. Lay out the two sides 5/8" wide x 1-1/2" thick.
5. Machine to layout lines by turning in vise and cut to 5/8" thick x 1-1/2" wide.
6. Place in vise, one end up, and square from one side, cut 1/16" off of one end.
7. Lay out 1-1/2" length, square up in vise and machine to 1-1/2" length on opposite end.
8. Lay out 45º x 1/2" corner and machine to line.
9. Lay out and cut the 1/8" x 3/4" notch in one side.
10. Lay out top surface for 5/8" and #9 drill holes.
11. Lay out the two sides for 1/2" - 20 NC tapped holes.
12. Place in vise, drill and ream two 5/8" holes (use 3/8" and 39/64" drills first).

Item 1 - Solid Jaw (Cont.)

PROCEDURES OR STEPS: (Cont.)

13. Drill and counterbore for the two - 5/16" holes.

14. Drill and tap two - 1/4" - 20 NC holes on the sides.

SUGGESTION:

The 5/8" reamed holes on the solid jaw, movable jaw, and rear support could be drilled 39/64" and reamed at one setting so that the 5/8" bars will line up. For accuracy, drill 1/4" hole and the 1/2" hole in each piece separately before drilling the 39/64" hole.

Item 4 - Keeper Washer

STOCK:

C.R.S.

TOOLS:

1/4" Drill	Center drill	Combination square
6" Mill file	Layout dye	Hammer
	Scriber	

PROCEDURES OR STEPS:

1. Select 3/4" dia. CR steel.
2. Chuck true in lathe chuck.
3. Face one end.
4. Center drill.
5. Turn dia. to 5/8".
6. Drill 1/4" hole.
7. Cut off to 3/16" thickness.
8. File sharp corners.
9. Layout 1/4" slot.
10. Saw and file 1/4" slot.

Item 5 - Thrust Washer

STOCK:

C.R.S.

TOOLS:

Combination square	3/8" Drill	Layout dye
#9 Drill	Center punch	Scriber
	Hammer	

PROCEDURES OR STEPS:

1. Select CR steel 1/4" x 1" x 1-3/8".
2. Machine to size 1/4" x 7/8" x 1-5/16".
3. Lay out for 3/8" hole.
4. Lay out two #9 holes.
5. Drill 3/8" hole.
6. Drill #9 holes.
7. File all sharp corners.

Item 9 - Rear Support

STOCK:

C.R.S.

TOOLS:

Combination square	#7 Drill	1/2" Drill
Scriber	39/64" Drill	1/4" - 20 NC Tap
Center punch	27/64" Drill	5/8" Machine reamer
1/2" - 13 NC Tap		Layout dye

PROCEDURES OR STEPS:

1. Select stock 3/4" x 1-5/8" x 2-5/8".
2. Square stock to 5/8" x 1-1/2" x 2-1/2".
3. Layout as per drawing.
4. Machine 1/4" x 9/16" angles.
5. Drill #7 holes.
6. Drill 27/64" hole.
7. Tap 1/4" - 20 holes.
8. Tap 1/2" - 13 holes.
9. Drill 39/64" holes (use 1/2" pilot drill).
10. Ream 5/8" holes.
11. Break all corners.

Item 3 - Movable Jaw

STOCK:

C.R.S.

TOOLS:

Combination square	5/16" Counterbore	Center punch
Scriber	Layout dye	Hammer
3/8" Drill	5/8" Counterbore	#9 Drill
39/64" Drill	1/2" Drill	#10-32 NF Tap
#21 Drill	5/8" Machine reamer	

PROCEDURES OR STEPS:

1. Select stock 3/4" x 1-5/8" x 2-5/8".
2. Square stock to 5/8" x 1-1/2" x 2-1/2".
3. Layout as per drawing.
4. Drill #21 holes and tap 10 - 32 NF.
5. Drill #9, two holes.
6. Drill 3/8" hole.
7. Drill 39/64 holes (use 1/2" pilot hole).
8. Ream 5/8", two holes.
9. Counterbore 5/16" x 3/16" deep, two holes.
10. Counterbore 5/8" x 3/16" deep.
11. Machine 1/8" x 3/4" step.
12. Break all corners.

Item 7 - Vise Ways

STOCK:

C.R.S.

TOOLS:

Scale
Scriber

PROCEDURES OR STEPS:

1. Select two 5/8" dia. x 5-1/4" long CR steel shafts.
2. Chuck in lathe and face 1/16" off of both ends to 5-1/2" length.
3. Bevel ends to 1/16" x 45^{o}.
4. Polish 5/8" diameters.

Item 10 - Screw

STOCK:

C.R.S.

TOOLS:

Combination center head	Hammer	Layout dye
Center punch		Lathe cut-off tool

PROCEDURES OR STEPS:

1. Select 3/4" dia. x 5" CR steel.
2. Chuck true in lathe, face ends to 4-15/16" length.
3. Center drill both ends.
4. Turn 11/16" dia. x 3/4" long.
5. Turn 1/2" dia. x 4-3/16" long.
6. Turn 3/8" dia. x 11/16" long.
7. Notch at large end 1/2" x 27/64" dia.
8. Notch at small end 1/4" dia. x 3/16" wide.
9. Cut 1/2" - 13 NC threads on shaft.
10. Turn 1/16" x 45^{o} angle.
11. Layout 17/64" hole with combination center head.
12. Drill 17/64" hole.

Item 11 - Knob, Handle

STOCK:

C.R.S.

TOOLS:

3/16" Reamer 1/32" Drill 11/32" Drill
Scale

PROCEDURES OR STEPS:

1. Select 1/2" dia. x 5/8" long CR steel.
2. Chuck true in lathe.
3. Face both ends to 1/2" long.
4. Center drill.
5. Drill with 11/32" drill x 3/8" deep.
6. Ream 3/16" x 3/8" deep.
7. Drill 1/32" hole in end.
8. Bevel edge 1/16" x 45^{o}.

Item 2 - Jaw Insert

STOCK:

C.R.S.

TOOLS:

Layout dye	Hammer	Scriber
Combination square	Center punch	#29 Drill
	#10-32 NF Tap	

PROCEDURES OR STEPS:

1. Select stock 3/16" x 7/8" x 2-5/8" tool steel.
2. Machine to 3/16" x 7/8" x 2-5/8".
3. Lay out for two #10 - 32 NF tapped holes.
4. Drill with #29 drill.
5. Tap two holes with #10 - 32 NF tap.
6. Harden and draw temper.
7. Tapped holes should be transferred from Item #1 - Solid Jaw and Item #3 - Movable Jaw.

Item 12 - Pin Handle

STOCK:

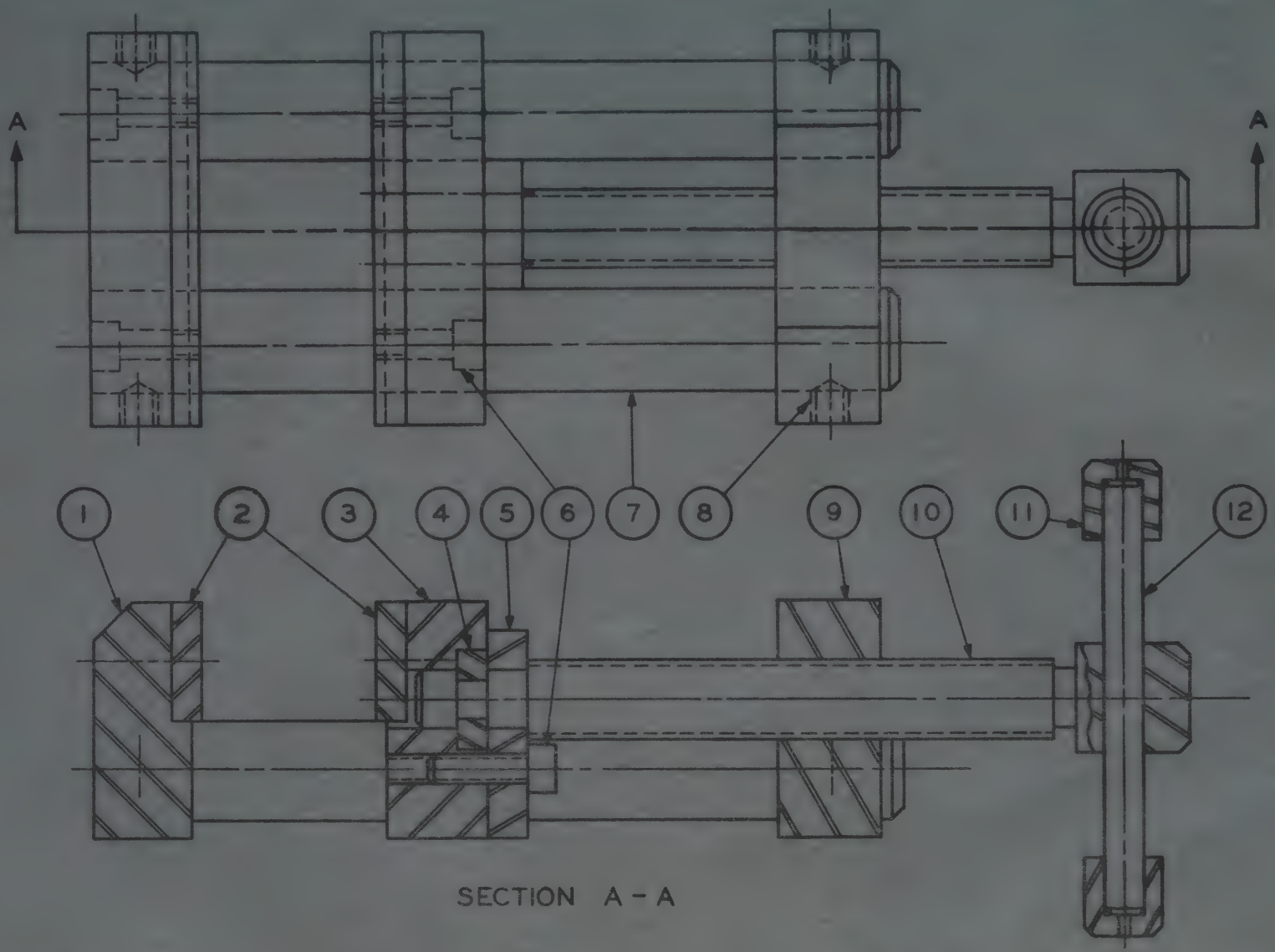
C.R.S.

TOOLS:

Scale Micrometer Scriber

PROCEDURES OR STEPS:

1. Select 1/4" dia. x 2-7/8" long, CR steel.
2. Turn both ends to .1885" x 7/16" long.
3. Bevel both ends.
4. Polish 1/4" dia.



SECTION A - A

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL AS LISTED	PART NAME	ASSEMBLY DRILL PRESS VISE
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD. 1	SCALE: FULL SHEET 1 OF 6
		USED ON	DWG. NO. 109 A 1

DRILL JIG PRESS ASSEMBLY DRAWING SHOWING SHUT HEIGHT SCALE TOO SMALL TO DIMENSION

ITEM NO.	PART NAME	NO. REQD.	MATERIAL AS LISTED	HEAT TREAT
1	BASE	1	CAST IRON	
2	LOCATING PIN	1	TOOL STEEL	RC 58-62
3	BUSHING	1	TOOL STEEL	RC 58-62
4	SPACER	1	STEEL	
5	SPACER	1	STEEL	
6	PLATE	1	STEEL	
7	PLATE	1	STEEL	
8	PLATE	1	STEEL	
9	BUSHING	1	TOOL STEEL	RC 58-62
10	BUSHING	1	TOOL STEEL	RC 58-62
11	PIN	1	TOOL STEEL	RC 58-62
15	HANDLE	1	STEEL	

SCALE: FULL | SHEET 1 OF 1

NO. REQD. 1

USED ON

DWG. NO. 101 A

DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64"; DECIMAL ±.005; ANGULAR ±2°
TRUE CENTERS BETWEEN HOLES TO BE WITHIN ±.003 TO CENTER LINE. CONCENTRICITY ±.001
SURFACE FINISHES SPECIFIED:

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
12	1	A6	PIN, HANDLE	C.R.S.	$\frac{1}{4}$ DIA x $2\frac{7}{8}$
11	2	A5	KNOB, HANDLE	C.R.S.	$\frac{1}{2}$ DIA x $\frac{1}{2}$
10	1	A5	SCREW	C.R.S.	$\frac{1}{2}$ DIA x $4\frac{15}{16}$
9	1	A4	REAR SUPPORT	——	$\frac{5}{8}$ x $1\frac{1}{2}$ x $2\frac{1}{2}$
8	4		SOCKET HD, CONE POINT, SET SCREW	PUR'D	$\frac{1}{4}$-20 NC-2 x $\frac{1}{4}$ LONG
7	2	A5	WAYS, VISE	C.R.S.	$\frac{5}{8}$ x $\frac{5}{8}$ x $5\frac{5}{8}$
6	4		HEX HD CAP SCREW · SOCKET HD CAP SCREW	PUR'D	
5	1	A3	THRUST WASHER	C.R.S.	$\frac{1}{4}$ x $\frac{7}{8}$ x $1\frac{15}{16}$
4	1	A3	KEEPER WASHER	C.R.S.	$\frac{3}{16}$ x $\frac{5}{8}$ x $\frac{5}{8}$
3	1	A4	MOVEABLE JAW	C.R.S.	$2\frac{1}{2}$ x $1\frac{1}{2}$ x $\frac{5}{8}$
2	2	A6	JAW INSERT	——	$2\frac{1}{2}$ x $\frac{3}{4}$ x $\frac{3}{16}$
1	1	A3	SOLID JAW	C.R.S.	$2\frac{1}{2}$ x $1\frac{1}{2}$ x $\frac{5}{8}$

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL

HEAT TREAT

PART NAME: ASSEMBLY BILL OF MATERIAL
DRILL PRESS VISE

NO. REQD. | SCALE: | SHEET 2 OF 6

USED ON | DWG. NO. 109 A 2

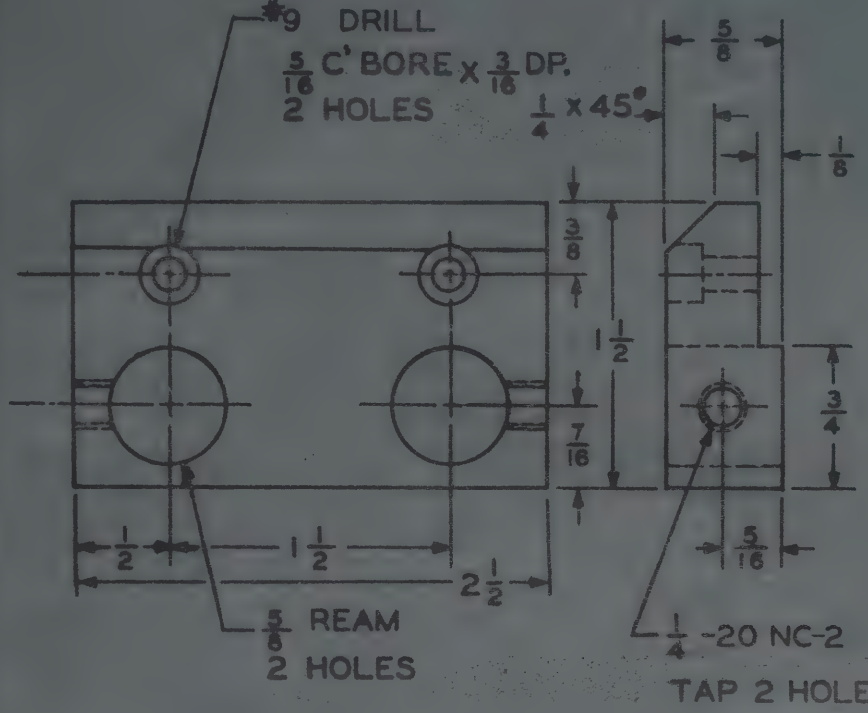
ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
12	1	A6	PIN, HANDLE	C.R.S.	$\frac{1}{4}$ DIA x $2\frac{1}{8}$
11	2	A5	KNOB, HANDLE	C.R.S.	$\frac{1}{2}$ DIA x $\frac{1}{2}$
10	1	A5	SCREW	C.R.S.	$\frac{1}{2}$ DIA x $4\frac{15}{16}$
9	1	A4	REAR SUPPORT	——	$\frac{3}{8}$ x $1\frac{1}{2}$ x $2\frac{1}{2}$
8	4		SOCKET HD. CONE POINT, SET SCREW	PUR'D	$\frac{1}{4}$—20 UNC-S x $\frac{1}{4}$ LONG
7	2	A5	WAYS, VISE	C.R.S.	$\frac{5}{8}$ x $\frac{5}{8}$ x $5\frac{5}{8}$
6	4		HEX HD CAP SCREW SOCKET HD CAP SCREW	PUR'D	
5	1	A3	THRUST WASHER	C.R.S.	$\frac{1}{4}$ x $\frac{7}{8}$ x $\frac{15}{16}$
4	1	A3	KEEPER WASHER	C.R.S.	$\frac{3}{16}$ x $\frac{2}{8}$ x $\frac{2}{8}$
3	1	A4	MOVEABLE JAW	C.R.S.	$2\frac{5}{8}$ x $1\frac{1}{2}$ x $\frac{2}{8}$
2	2	A6	JAW INSERT	——	$2\frac{1}{2}$ x $\frac{3}{4}$ x $\frac{3}{16}$
1	1	A3	SOLID JAW	C.R.S.	$2\frac{5}{8}$ x $1\frac{1}{8}$ x $\frac{2}{8}$

MATERIAL		PART NAME	ASSEMBLY DRILL PRESS VISE
HEAT TREAT		NO. REQD.	SCALE:
		USED ON	DWG. NO. 109A2

DO NOT SCALE THIS DRAWING

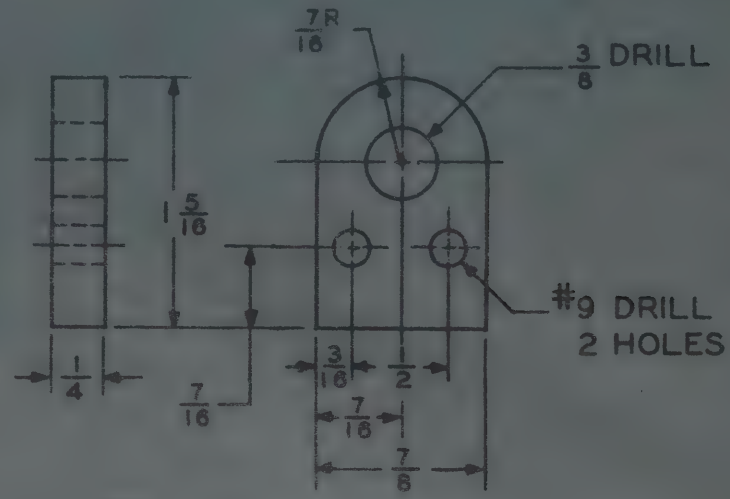
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.003; ANGULAR ±°
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.03



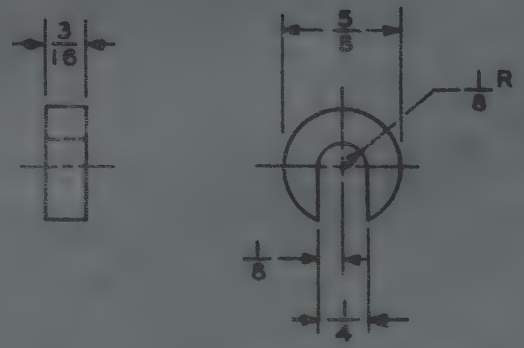
(1) SOLID JAW

C.R.S. 1 REQ'D



(5) THRUST WASHER

1 REQ'D



(4) KEEPER WASHER

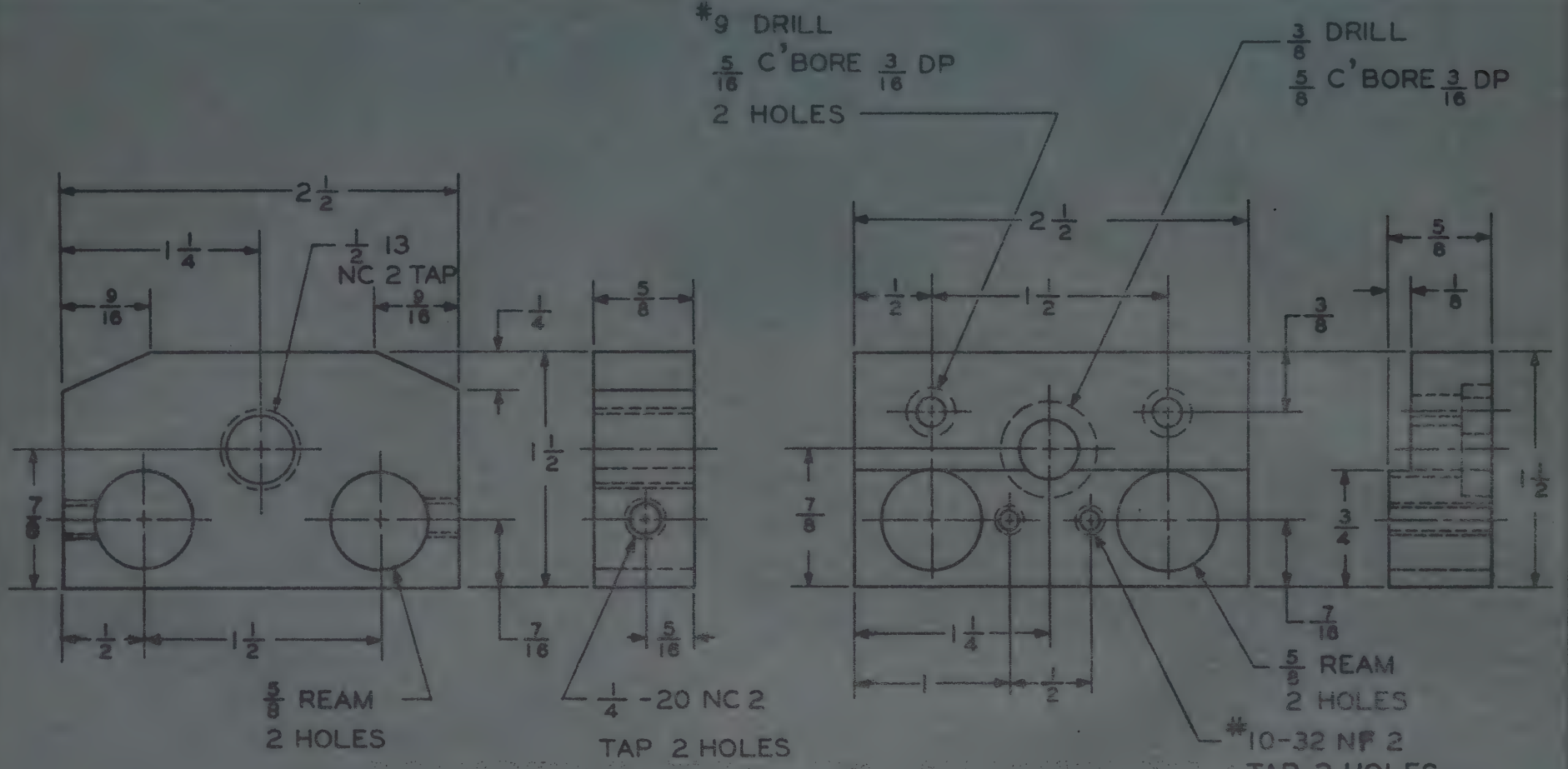
C.R.S. 1 REQ'D

NOTE: FINISH ALL OVER

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	(1) (4) & (5)
			DRILL PRESS VISE
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 3 OF 6
		USED ON 109 A 1	DWG. NO. 109 A 3

DRILL
2 HOLES
THRUST WASHER
1 REQ'D
KEEPER WASHER
1 REQ'D
C.R.S.
4
DRILL
2 HOLES
TAP 2 HOLES
REAM
2 HOLES
SOLID JAW
1 REQ'D
C.R.S.
1
NOTE: FINISH ALL OVER
THE OHIO TRACTOR AND INDUSTRIAL EQUIPMENT SERVICE
DO NOT SCALE THIS DRAWING
USED ON 1091 A
MATERIAL
HEAT TREAT
PART NAME
PART NO.
DWG. NO.
DRILL PRESS VISE
1 OF 1 SHEET
DWG. NO. 1091 A-5



(9) REAR SUPPORT

C. R. S. 1 REQ'D

(3) MOVEABLE JAW

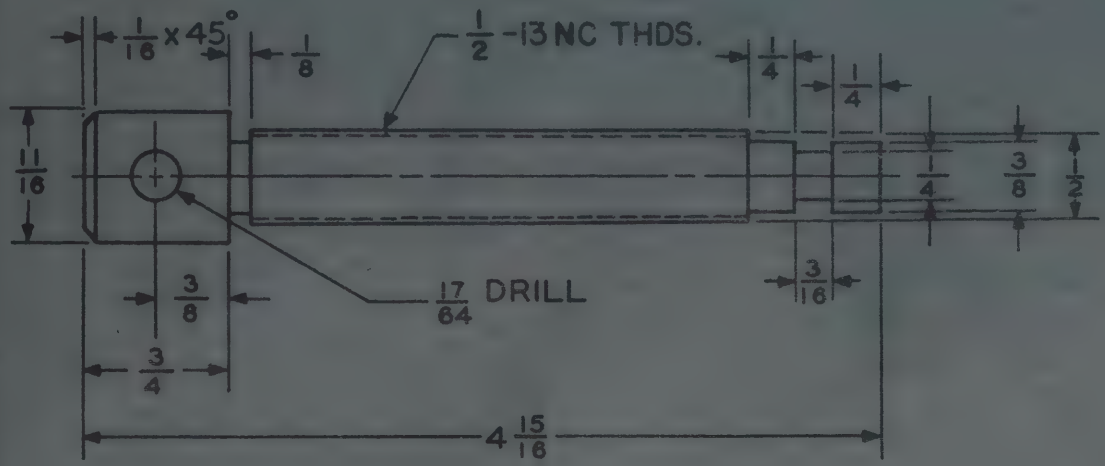
C. R. S. 1 REQ'D

NOTE: FINISH ALL OVER

DO NOT SCALE THIS DRAWING

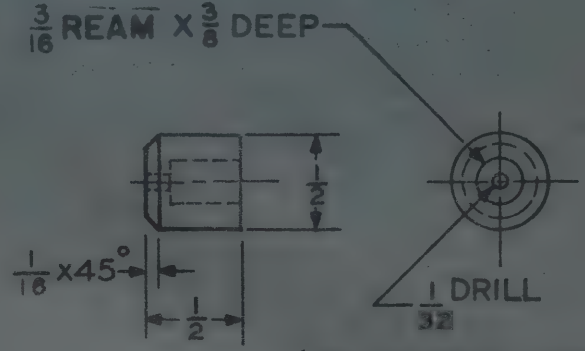
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	(9) (3) DRILL PRESS VISE
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.03; ANGULAR 2°	HEAT TREAT	NO. REQD. / SCALE: / SHEET 4 OF 6	
		USED ON 109 A 1	DWG. NO. 109 A 4

#3 DRILL
13/32 DIA C'BORE 3/16 DP
2 HOLES
DRILL
13/32 DIA C'BORE 3/16 DP
2 HOLES
REAM
2 HOLES
#10-32 NF 2
TAP 2 HOLES
REAR SUPPORT
(3) REQ'D
REAM
2 HOLES
1/4-20 NC 2
TAP 2 HOLES
13/64 DRILL
3/8 DP
2 HOLES
MOVEABLE JAW
(3) REQ'D
C.R.S.
NOTE: FINISH ALL OVER
DO NOT SCALE THIS DRAWING
USED ON
NEXT ASSY
APPLICATION
QTY.
MATERIAL
PART NO.
NAME
DRILL PRESS VISE
DWG. NO. 109 A 101
SCALE
SHEET
109 A 4
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES: FRACTIONAL ±1/64 DECIMAL ±.005 ANGULAR ±1°
FINISH 125 MICRO INCH OR BETTER
SURFACES TO BE MACHINED ARE INDICATED BY



(10) SCREW

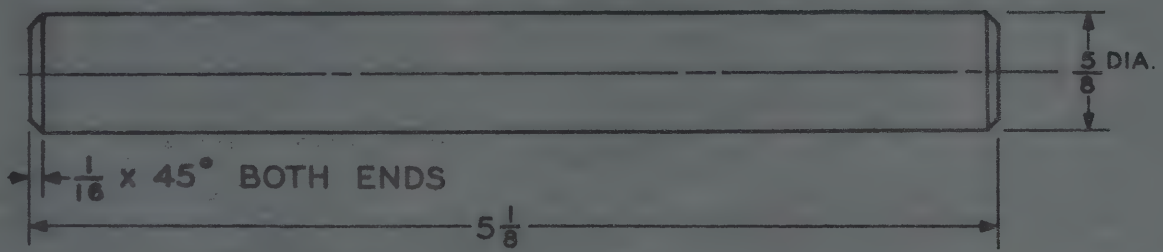
C.R.S. 1 REQD.



(TO RELIEVE PRESSURE)

(11) KNOB, HANDLE

C.R.S. 2 REQD.



(7) WAYS, VISE

C.R.S. 2 REQD.

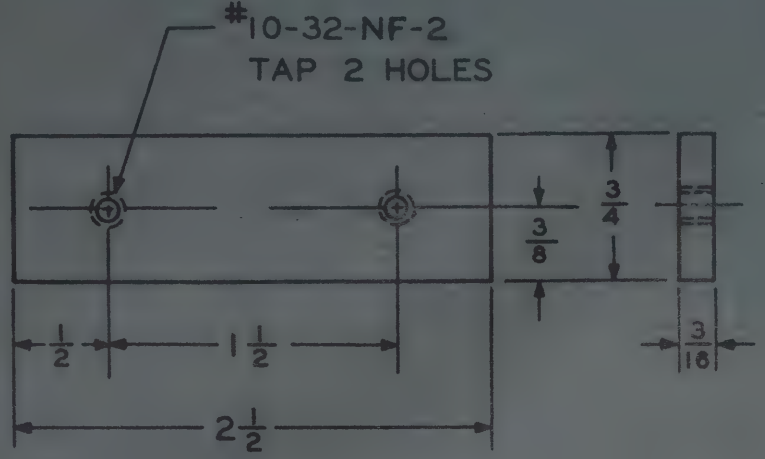
DO NOT SCALE THIS DRAWING

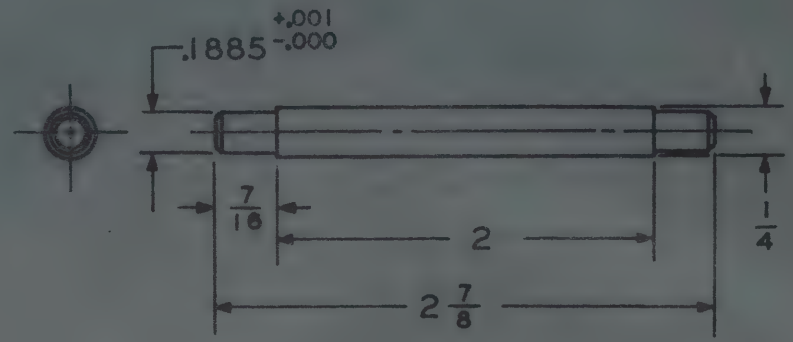
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	(7), (10) & (11)
			DRILL PRESS VISE
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 5 OF 6
		USED ON 109 A 1	DWG. NO. 109 A 5

DO NOT SCALE THIS DRAWING				
MATERIAL	PART NAME	(7), (10) & (11)	DRILL PRESS VISE	
HEAT TREAT	DWG. NO.	SCALE: FULL	SHEET 5 OF 6	
	USED ON	1009 AI	DWG. NO. 1009 A5	

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°





(2) JAW INSERT

T.S. 2 REQD.

HARDEN & TEMPER

(12) PIN, HANDLE

C. R. S. 1 REQD.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	(2) & (12) DRILL PRESS VISE
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 6 OF 6
		USED ON 109 A 1	DWG. NO. 109 A 6

PIN, HANDLE (1)
C.R.S. 1 REQD.

JAW INSERT (2)
T.S. 2 REQD.
HARDEN & TEMPER

DO NOT SCALE THIS DRAWING

MATERIAL			
HEAT TREAT			
NO. REQD.	PART NAME		
USED ON 1091 A	(1) & (2)	DRILL PRESS VISE	
DWG. NO. 1091A	SCALE: FULL	SHEET 5 OF 8	

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED : ±.003 WITHIN ±.001 CONSISTENCY
TRUE CENTERS WITHIN ±.003 OF CENTER LINE
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR ±2°

DRILL PRESS VISE

INTRODUCTORY INFORMATION:

A drill press vise is essential for holding work while performing various machine shop operations when drilling, reaming, spot facing, and counterboring.

STOCK:

Cold rolled steel and necessary castings.

SAFETY AND PRECAUTIONS:

1. Wear eye protection at all times.
2. Oil machine daily before starting work.
3. File all sharp corners off of machined surfaces.
4. Keep sleeves rolled up above the elbows.
5. Don't wear loose clothing or neck tie.
6. Do not wear gloves around machinery.
7. Observe all shop safety rules.

Item 1 - Body

STOCK:

Casting for body of drill press vise.

TOOLS:

Combination square set
Scriber
17/32" Drill
Mill cutter
5/8" - 11 NC tap
Hammer
Center punch
Mill file

PROCEDURES OR STEPS:

1. Select the proper casting for this job.
2. Shape 1/16" off bottom of base.
3. Machine 1/16" off one side.
4. Layout for 3" height x 3" wide x 7" long.
5. Machine top surface to 3" height.
6. Machine other side to 3-1/8" width.
7. Machine both ends to approximately 7" long, not necessary - can be done if desired.
8. Lay off opening to 1-3/4" high x 5" long.
9. Scribe lines for bottom of vise grooves according to end view.
10. Lay off end for 5/8" - 11 NC tapped hole.
11. Mill vise opening to layout lines.
12. Mill grooves on end as per layout.
13. Drill with 17/32" drill for screw.
14. Tap hole with 5/8" - 11 NC tap.
15. File all sharp edges.
16. Inspect as per drawing.

Item 2 - Jaw

STOCK:

Casting for jaw of drill press vise.

TOOLS:

Combination square set
Hammer
Center punch
15/32" Drill
1/4" Drill
5/16" - 18 NC tap
1/8" Drill
Mill file

PROCEDURES OR STEPS:

1. Secure the proper casting.
2. Shape 1/16" off front large surface.
3. Machine 1/16" off top.
4. Lay off all surfaces according to drawing.
5. Machine bottom surface to 2-3/8" height from top.
6. Machine tongue 1" wide x 5/8" long and jaw 1-3/4" high.
7. Machine both ends to 3" wide.
8. Layout for all drilled holes.
9. Drill 15/32" x 5/8" deep hole.
10. Drill two 1/4" holes for 5/16" - NC screws.
11. Tap two 5/16" - 18 NC bolt holes.
12. Locate and drill 1/8" pin hole at assembly.
13. File all sharp corners.
14. Check 100% as per drawing.

Item 4 - Screw

STOCK:

C. R. S.

TOOLS:

Ruler
Center drill
Micrometer
5/8" - 11 NC tap
Thread center gage
Drill for No. 2 taper pin
Reamer for No. 2 taper pin
Mill file
Hammer
Center punch

PROCEDURES OR STEPS:

1. Secure 5/8" dia. x 7-1/4" long C. R. steel.
2. Chuck true in lathe, face both ends to 7-5/64".
3. Center drill both ends.
4. Turn end to .465 dia.. x 49/64" long and bevel 120°.
5. Turn 1/8" groove according to 1/8" drill mark.
6. Cut 5/8" - 11 NC thread in lathe.
7. Drill hole for #2 taper pin, with hand knob assembled.
8. Bevel pin end of screw 45°.

Item 6 - Jaw Guide

STOCK:

C. R. S.

TOOLS:

Combination square set	Hammer
Center drill	7/16" Counterbore
Scriber	Mill file
Center punch	Emery cloth

PROCEDURES OR STEPS:

1. Secure 3/8" x 1-3/4" x 2-5/8" C. R. steel.
2. Machine to 3/8" x 1-13/16" x 2-1/2" long.
3. Layout and drill two 21/64" drilled holes.
4. Counterbore two holes 7/16" dia. x 1/4" deep.
5. File and polish all sharp edges.

Item 8 - Hand Wheel

STOCK:

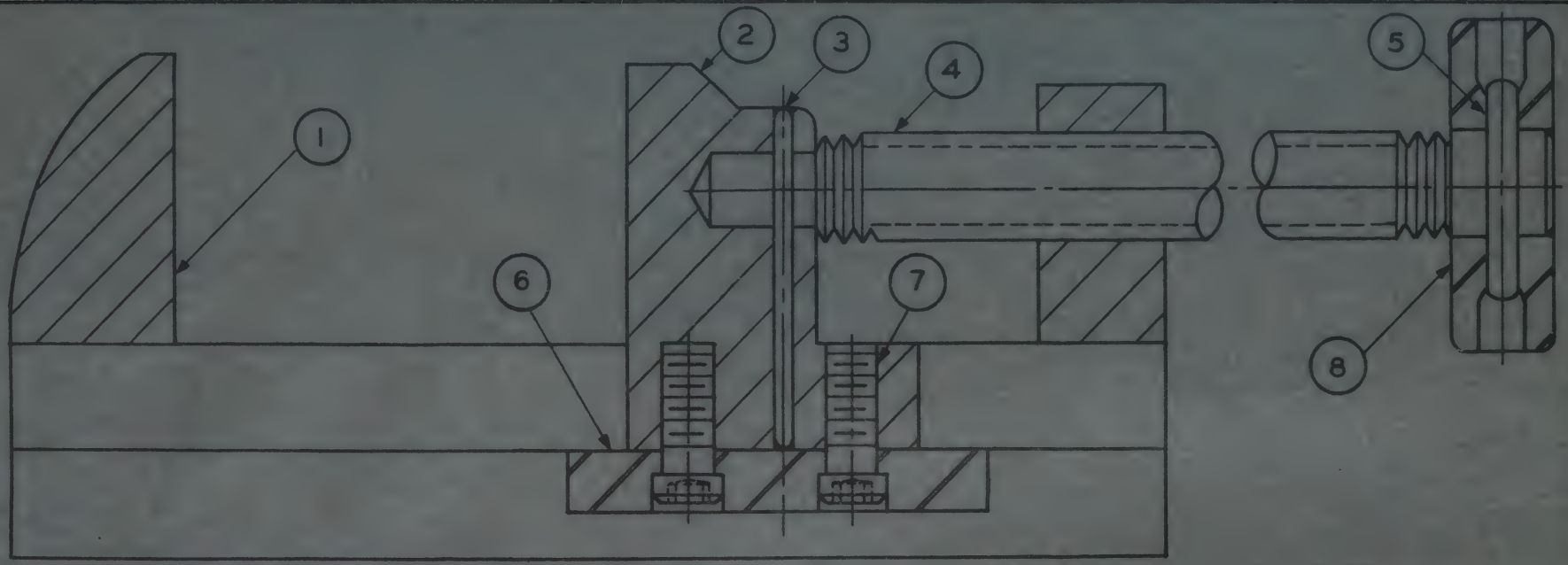
Casting for hand wheel of drill press vise.

TOOLS:

Ruler	39/64" Drill	Hammer
Outside caliper	5/8" Reamer	Center punch
Center drill	5/8" Mandrel	Scriber
1/2" Drill		Dividers

PROCEDURES OR STEPS:

1. Secure proper casting for hand wheel.
2. Chuck true in lathe, face 1-1/8" shoulder and true 1-1/8" diameter.
3. Center drill.
4. Drill 1/2" hole.
5. Drill 39/64" hole.
6. Machine ream 5/8" hole.
7. Place hand wheel on 5/8" mandrel.
8. Face opposite side to 13/16" width.
9. Layout for four 5/16" holes x 3/8" deep, equally spaced.
10. Drill and ream taper pin hole at assembly.



ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
8	1	A4	HAND WHEEL	C. I.	$\frac{3}{4}$ x 2
7	2	PUR.	SOC. HD. CAP SCR.	S.	$\frac{5}{16}$ x $\frac{7}{8}$ LG.
6	1	A4	JAW GUIDE	C.R.S.	$\frac{3}{8}$ x 1 $\frac{13}{16}$ x 2 $\frac{1}{2}$
5	1	PUR.	NO. 2. TAPER PIN	C.R.S.	1 $\frac{1}{4}$ LONG
4	1	A4	SCREW	C.R.S.	$\frac{5}{8}$ x 7 $\frac{5}{64}$
3	2	PUR.	PIN	C.R.S.	$\frac{1}{8}$ x 2 x $\frac{1}{32}$
2	1	A3	JAW	C. I.	3 x 2 $\frac{5}{16}$ x 1 $\frac{11}{16}$
1	1	A2	BODY	C. I.	3 x 3 $\frac{13}{16}$ x 7

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ± $\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL

HEAT TREAT

PART NAME: ASSEMBLY DRILL PRESS
VISE

NO. REQD. | SCALE: | SHEET 1 OF 4

USED ON | DWG. NO. 110 A 1

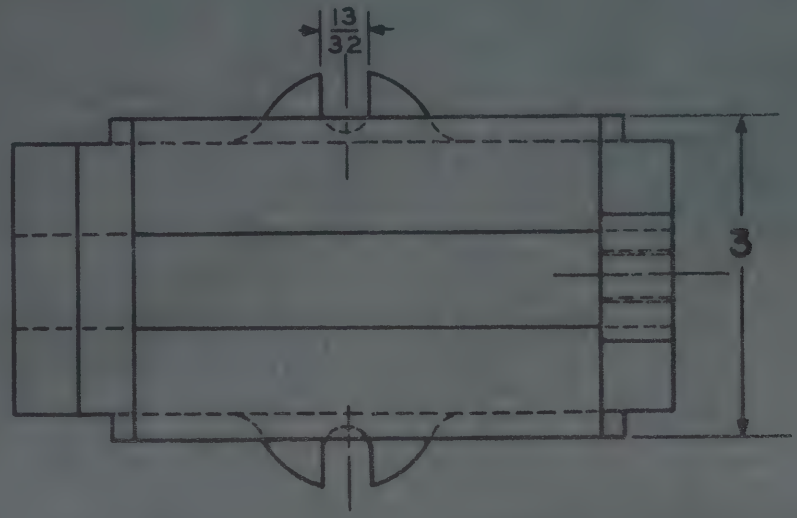
ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
8	1	A4	HAND WHEEL	C.I.	$\frac{3}{4}$ x S
7	2	PUR.	SOC. HD. CAP SCR.	S.	$\frac{5}{16}$ x $1\frac{7}{8}$ LG.
6	1	A4	JAW GUIDE	C.R.S.	$\frac{3}{8}$ x $1\frac{3}{16}$ x $2\frac{1}{2}$
5	1	PUR.	NO. 2 TAPER PIN	C.R.S.	$1\frac{1}{4}$ LONG
4	1	A4	SCREW	C.R.S.	$\frac{5}{8}$ x $1\frac{7}{8}$
3	2	PUR.	PIN	C.R.S.	$\frac{1}{8}$ x 2 x $\frac{3}{32}$
2	1	A3	JAW	C.I.	3x2$\frac{5}{8}$x$1\frac{11}{16}$
1	1	A2	BODY	C.I.	3x3$\frac{1}{8}$ x 7

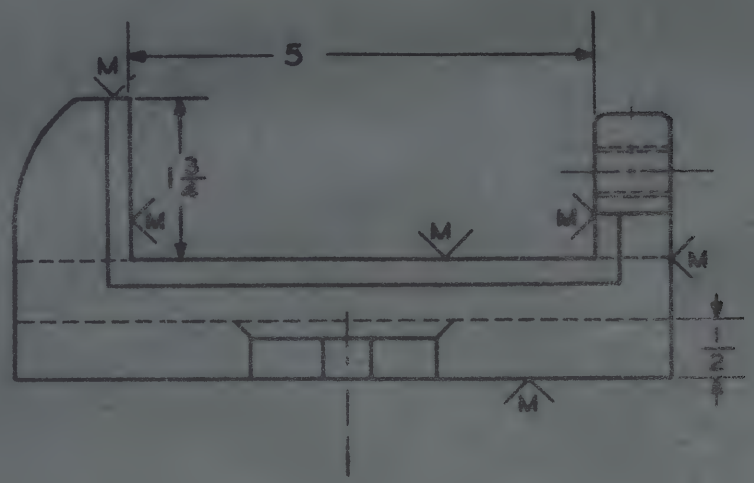
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

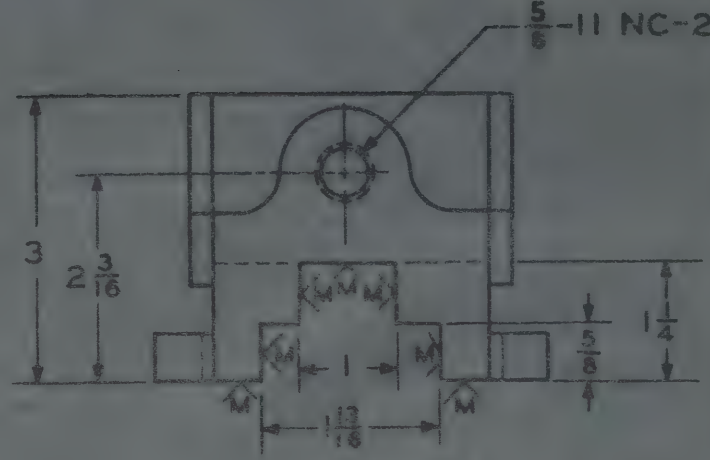
UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.005; ANGULAR ±2°

DO NOT SCALE THIS DRAWING

MATERIAL	PART NAME	ASSEMBLY DRILL PRESS VISE	
HEAT TREAT	NO. REQD.	SCALE:	SHEET 1 OF 4
	USED ON		DWG. NO. 110 A1



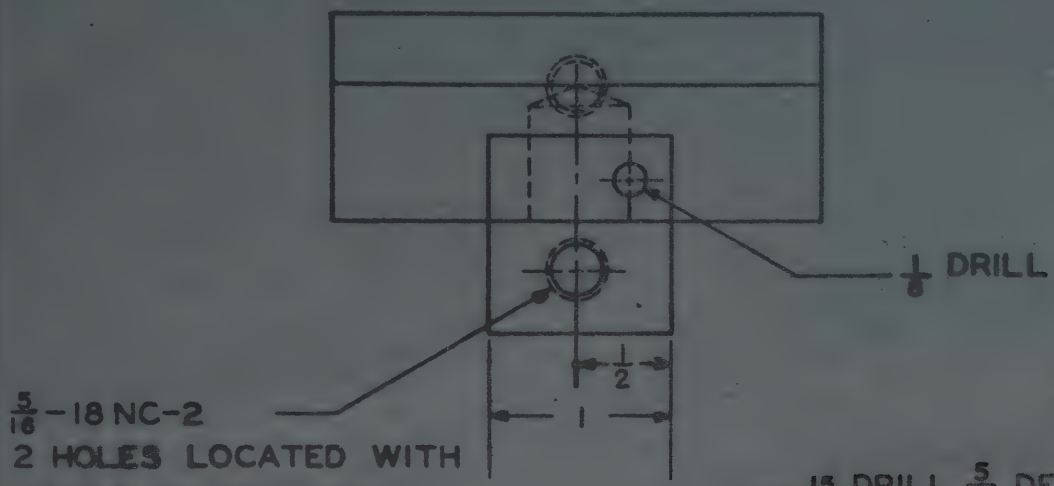


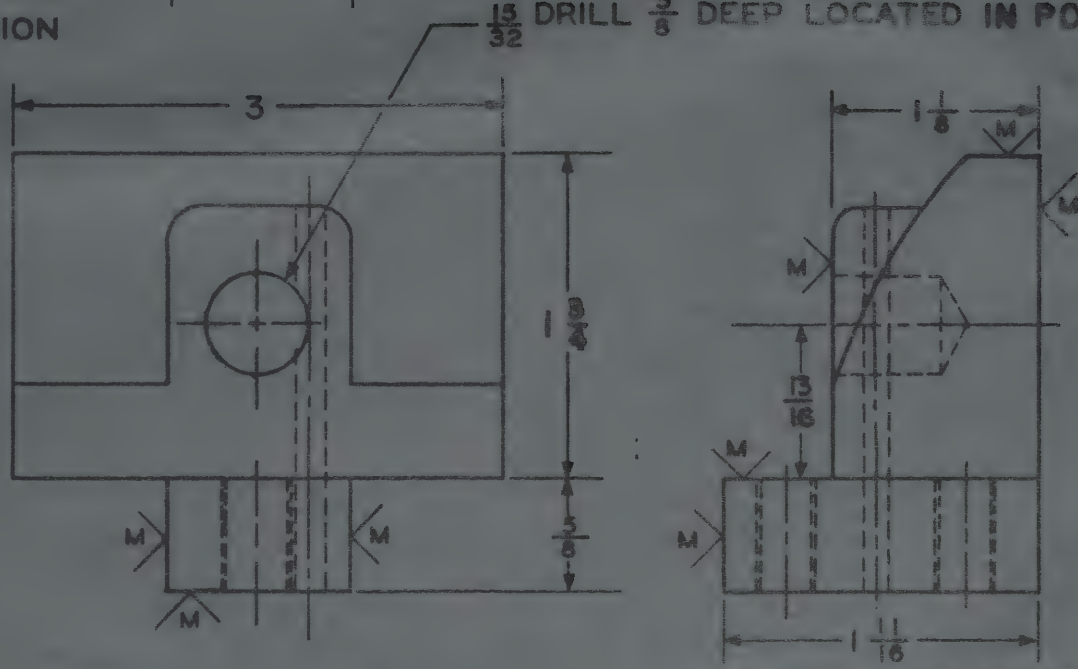


DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C. I.	PART NAME: (1) BODY	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT:	PART NAME: DRILL PRESS VISE	
		NO. REQD. 1	SCALE: HALF
		SHEET 2 OF 4	
		USED ON 110A1	DWG. NO. 110 A 2

3
5 9/16
1 1/8
2
2 1/2-11 NC-5
3
3 3/8
2

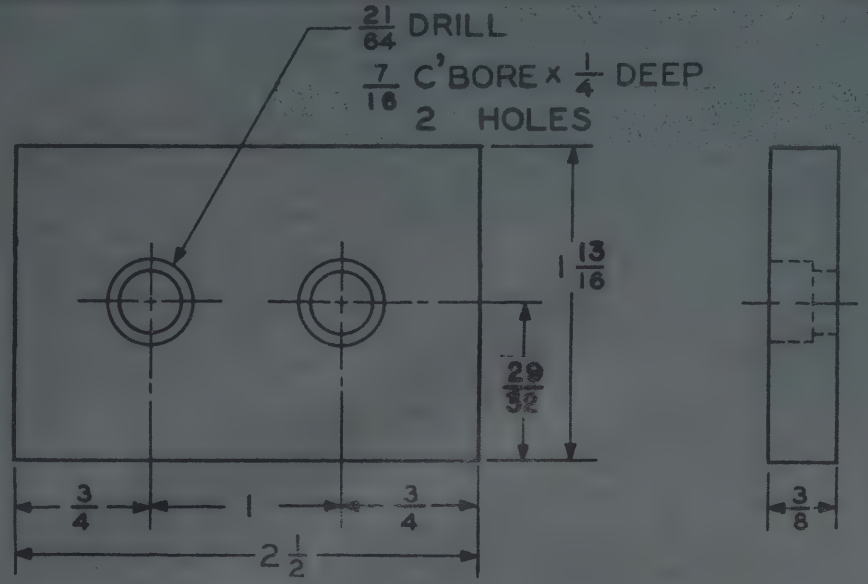




DO NOT SCALE THIS DRAWING

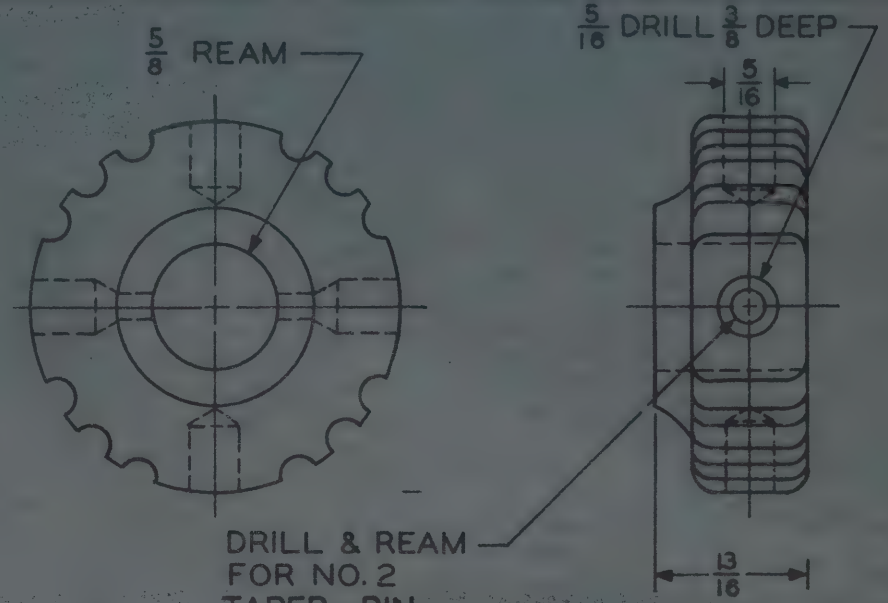
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C. I.	PART NAME: (2) JAW	
		DRILL PRESS VISE	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 3 OF 4
		USED ON 110 A 1	DWG. NO. 110 A 3

DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.005; ANGULAR ±1°. TAPER CENTERS WITHIN ±.003 TO CORRECT LINE. CONCENTRICITY ±.001 RADIUS CHAMFERS SPECIFIED:		NEED ON 1104	DWG. NO. 1104
THE OHIO ARC AND INDUSTRIAL EDUCATION SERVICE		NO BEND	PATTERN OUT
	HEAT TREAT	NAME	DRILL PRESS VISE
	C.I.	MAT'L	⑤
	MATERIAL	DO NOT SCALE THIS DRAWING	



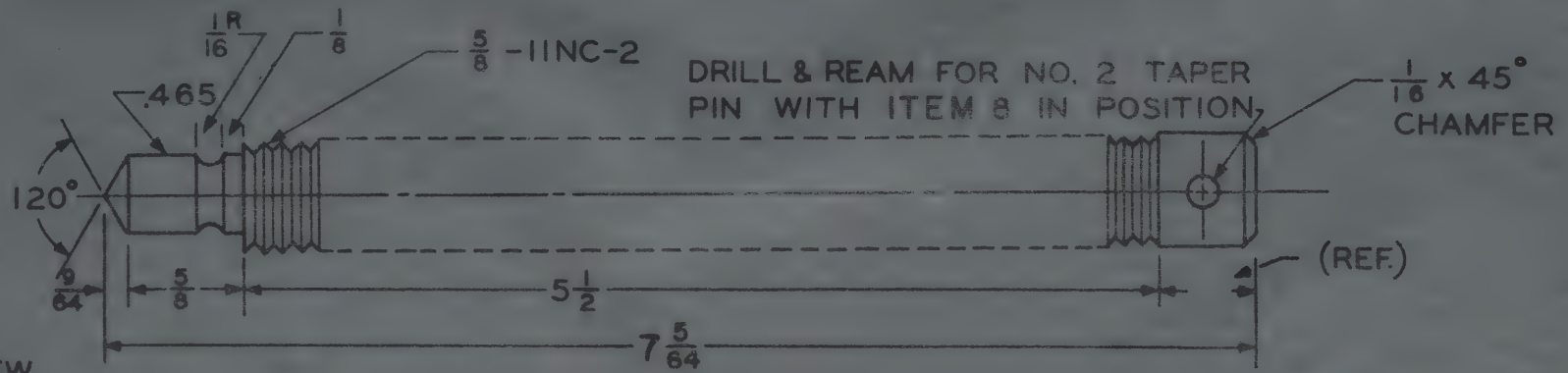
(6) JAW GUIDE

C. R. S. 1 REQD.



(8) HAND WHEEL

C. I. 1 REQD.



(4) SCREW

C. R. S. 1 REQD.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	NO. (4) (6) & (8)
			DRILL PRESS VISE
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 4 OF 4
		USED ON 110 A 1	DWG. NO. 110 A 4

DO NOT SCALE THIS DRAWING

MATERIAL	PART NO.	NAME	NO.
		DRILL PRESS VISE	(4) (6) & (8)

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

HEAT TREAT	SCALE: FULL	SHEET 4 OF 4
FINISH	DWG. NO. 110 A1	110 A4

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003; ANGULAR ±2°
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.005

V-BLOCK, 4 INCH

INTRODUCTORY INFORMATION:

V-blocks are very useful tools for machine shop work. They are used for drilling holes, holding round material in mill and shaper vises, and for bench and assembly work.

STOCK:

Cast iron.

SAFETY AND PRECAUTIONS:

1. Observe all shop safety rules.

V-Block, 4 Inch

STOCK:

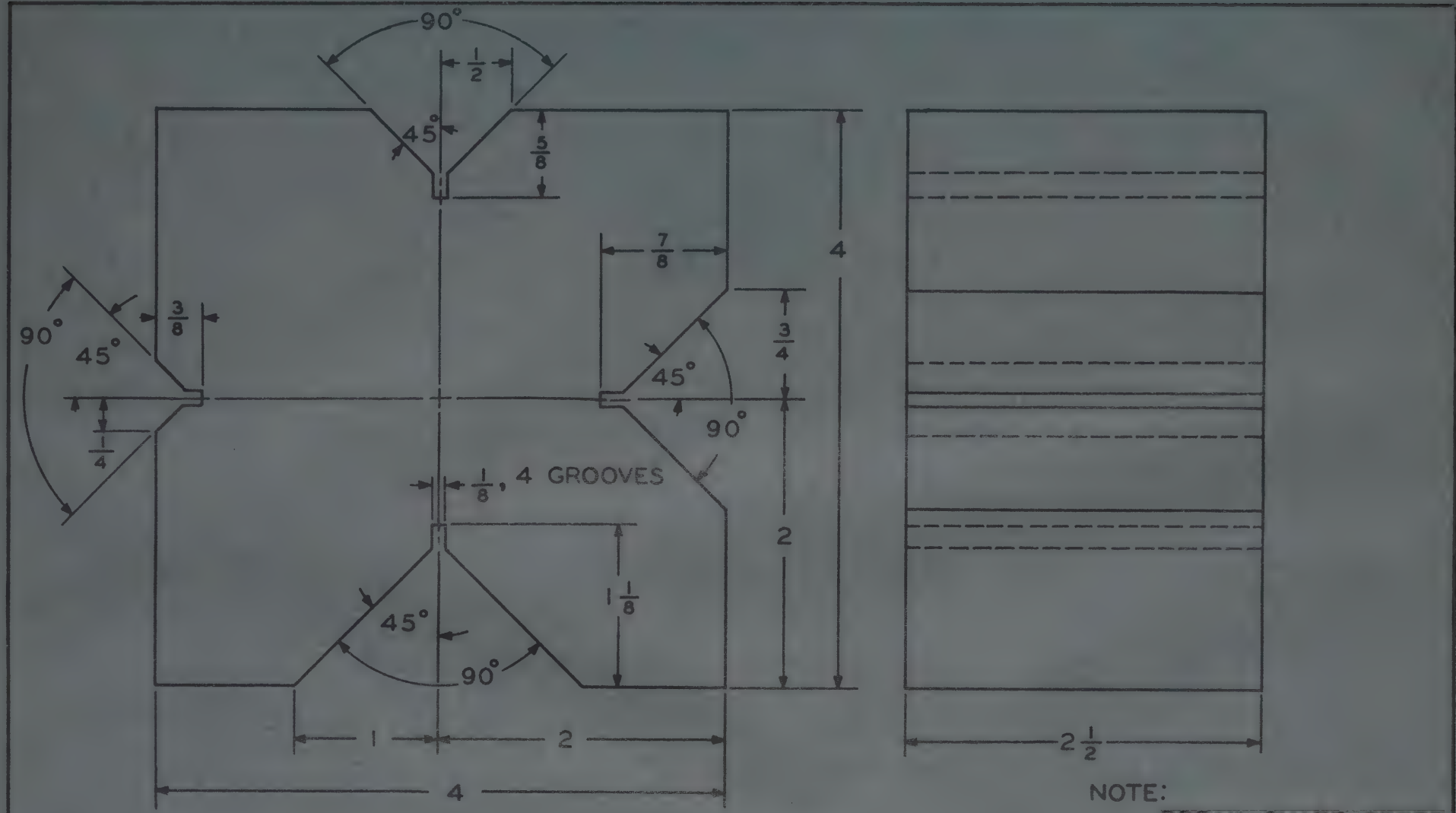
C.I.

TOOLS:

Combination square set
Layout dye
1/8" Cut-off tool or
1/8" Mill saw
Scriber
Hammer
Center punch
10" Mill file
Bevel protractor

PROCEDURES OR STEPS:

1. Place casting in machine vise.
2. Machine 1/8" off one side.
3. Machine 1/8" off adjacent side.
4. Cover two surfaces with layout dye.
5. Lay out for 4" width and 4" length.
6. Lay out the four 90^{o} - V's as per drawing.
7. Lay out the four 1/8" x 1/8" grooves.
8. Machine the other two sides 4" square.
9. Machine the four 90^{o} - V's as per drawing.
10. Machine the 1/8" relief grooves.
11. Draw file and polish all over.
12. File all corners.
13. Inspect as per drawing.



NOTE:
BREAK SHARP EDGES

NOTE:
ALL 90° ANGULAR TOLERANCES ±30'

FINISH ALL OVER

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C. I.	PART NAME: V-BLOCK, 4"	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD. 2	SCALE: FULL SHEET 1 OF 1
		USED ON	DWG. NO. 111 A 1

DO NOT SCALE THIS DRAWING

MATERIAL	C. I.		USED ON	
HEAT TREAT				
NAME	DATE			
DRAWN	J.LUTZ	5/20/63		
TRACED				
CHECKED				
ENGINEER				
APPROVED				

V-BLOCK, 4"

SIZE A | DWG. NO. | | SHEET 1 OF 1

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

ALL 90° ANGULAR TOLERANCES ±30'.

NOTE:

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE TO BE WITHIN THE FOLLOWING TOLERANCES:
FRACTIONAL ±1/64; DECIMAL ±.005; ANGULAR ±1°

C CLAMP

INTRODUCTORY INFORMATION:

The C clamp is a very useful tool for machine shop work while clamping work without marring the surface, and is used to clamp duplicate work while drilling, machining, filing and welding.

STOCK:

Machine and cold rolled steel.

SAFETY AND PRECAUTIONS:

1. Keep sleeves rolled up above the elbows.
2. Always keep a file handle on file tang.
3. Clamp work securely while drilling and machining.
4. File off all sharp edges of work.
5. Make sure that drill is sharpened correctly.
6. Follow all shop safety rules.

Item 1 - Body

STOCK:

C. R. S.

TOOLS:

Layout fluid	Center punch	3/8" - 24 NF Tap
Combination square set	Center drill	10" Mill file
Scriber	1/2" Drill	Steel rule
Hammer		Q Drill

PROCEDURES OR STEPS:

1. Secure 1" x 2-1/8" x 4-1/8" cold rolled or machine steel, rough saw to length.
2. Shape 1/8" off top surface.
3. Machine 1/8" off adjacent side.
4. Cover the two surfaces with layout dye.
5. Scriber lines on top and side 3/4" wide x 2" thick x 4" long.
6. Layout 1-1/4" x 2-3/8" lines for clamp opening.
7. Scribe two circles for corner fillets.
8. Layout the three beveled corners 1/2" x 45^{o}.
9. Prick punch lightly on all sides.
10. Machine to 3/4" thickness and 2" width.
11. Square up one side in vise, machine 1/8" off one end.
12. Machine 1/8" off other end to 4" length.
13. Center drill for two 1/2" fillet holes.
14. Drill two 1/2" holes.
15. Mill or shape 1-1/4" x 2-3/8" clamp opening.

Item 1 - Body (Continued)

PROCEDURES OR STEPS: (Continued)

16. Machine the three beveled corners to 1/2" x 45^{o}.

17. Layout for 3/8" - 24 NF screw.

18. Center drill for hole to be drilled with a Q drill.

19. Drill Q hole. (If Q drill is not available, use 21/64" drill.)

20. Tap hole for 3/8" - 24 NF screw.

21. File sharp corners off all edges.

22. Inspect as per drawing.

Item 2 - Button Tip

STOCK:

C. R. S.

TOOLS:

Steel rule
Center drill
1/4" Drill
3/8" Drill
File

PROCEDURES OR STEPS:

1. Secure 3/4" C. R. S.
2. Hold stock in lathe collet.
3. Face one end.
4. Drill 1/4" hole x 1/2" deep.
5. Drill 3/8" hole x 1/8" deep.
6. Form chamfer 1/2" dia. x 26^{o} 30'.
7. File sharp edges.
8. File and polish.
9. Cut off 3/8" long.
10. Rivet button to screw when assembled.

Item 3 - Screw

STOCK:

C. R. S.

TOOLS:

Steel rule	Layout fluid	Hammer
Center Drill	Combination square set	Center punch
Micrometer	Scriber	11/64" Drill
File		3/16" Machine reamer

PROCEDURES OR STEPS:

1. Use 1/2" dia. C. R. S. x 4" long.
2. Hold stock in lathe collet, face one end.
3. Center drill, allow 1/4" length to cut out center.
4. Support end with lathe tail stock center.
5. Turn 3/8" dia. x 3-5/16" long.
6. Turn .240" dia. x 9/32" long.
7. Chase 3/8" - 24 NF threads in lathe.
8. Cut off 1/2" dia. x 9/16" long.
9. Saw off 1/4" on end to eliminate center.
10. File and polish crown on end of 1/2" dia.
11. Lay out 3/16" hole on 1/2" dia.
12. Drill 11/64" hole.
13. Ream with 3/16" machine reamer.

Item 4 - Pin

STOCK:

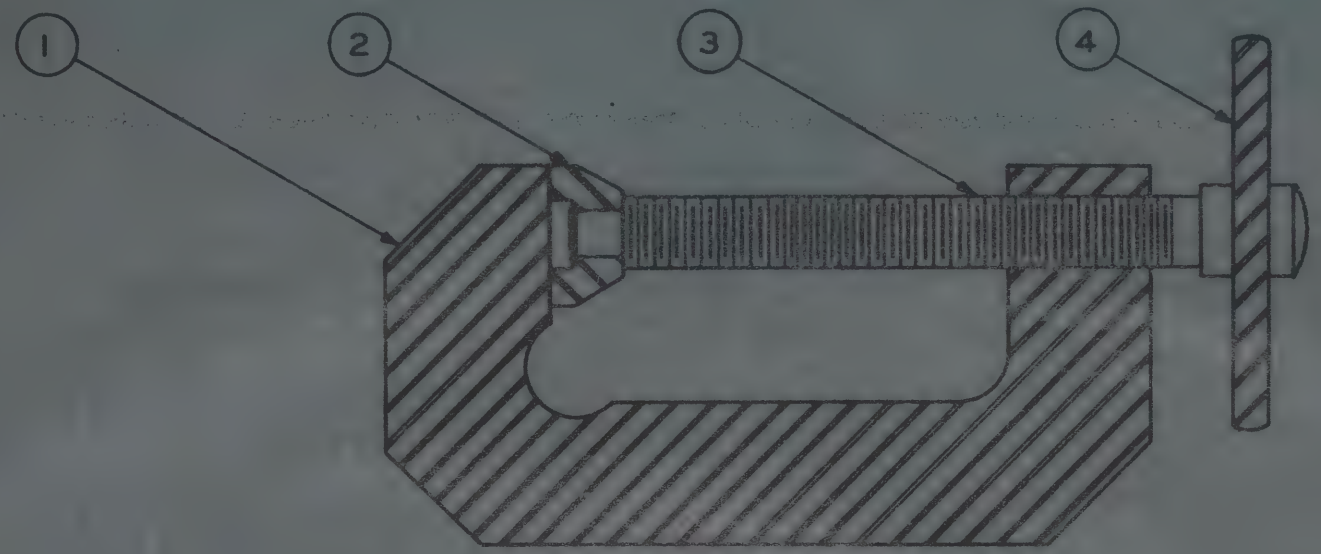
C. R. S.

TOOLS:

Steel rule
File
Emery cloth

PROCEDURES OR STEPS:

1. Secure 3/16" dia. x 2" long C. R. S.
2. File crown on both ends.
3. Knurl 3/8" length in center of pin.
4. Polish ends.



ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
4	1	A3	PIN	C.R.S.	$\frac{3}{16}$ D x $2\frac{1}{8}$
3	1	A3	SCREW	C.R.S.	$\frac{1}{2}$ D x 4
2	1	A3	BUTTON TIP	C.R.S.	$\frac{3}{4}$ D x $\frac{1}{2}$
1	1	A2	BODY	C.R.S.	$\frac{3}{4}$ x 2 x $4\frac{1}{8}$

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL: C.R.S.

HEAT TREAT:

PART NAME: ASSEMBLY C CLAMP

NO. REQD. 1 | SCALE: FULL | SHEET 1 OF 3

USED ON

DWG. NO. 112 A 1

DIMENSIONS TOLERANCES: FRACTIONAL ±1/64 ; DECIMAL ±.005 ; ANGULAR ±1°
TAPER CENTER MILLING ±.003 OF CENTER LINE. CONCENTRICITY ±.001
UNLESS OTHERWISE SPECIFIED:

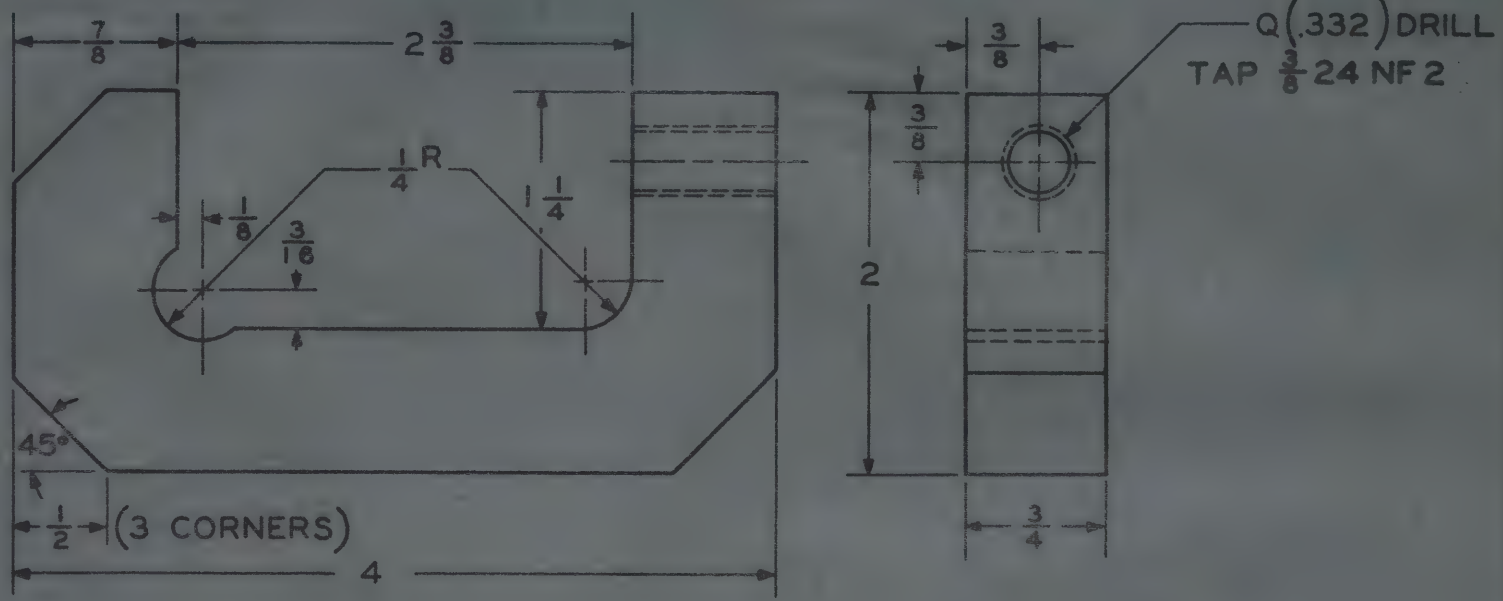
NEXT ASSY		USED ON	DWG. NO. 115 A 1
APPLICATION		NO. REQD. 1	SCALE: FULL SHEET 1 OF 2
FINISH		NAME	
MATL			

DO NOT SCALE THIS DRAWING

THE OHIO STATE UNIVERSITY INDUSTRIAL EDUCATION SERVICE

3 C CLAMP ASSEMBLY

ITEM	NO. REQD.	DWG. NO.	PART NAME	MATL.	SIZE
4	1	A3	PIN	C.R.S.	$\frac{3}{16}$ D × $\frac{1}{8}$ S
3	1	A3	SCREW	C.R.S.	$\frac{1}{2}$ D × 4
2	1	A3	BUTTON TIP	C.R.S.	$\frac{3}{4}$ D × $\frac{1}{2}$
1	1	A2	BODY	C.R.S.	$\frac{3}{4}$ × 5 × $\frac{1}{8}$



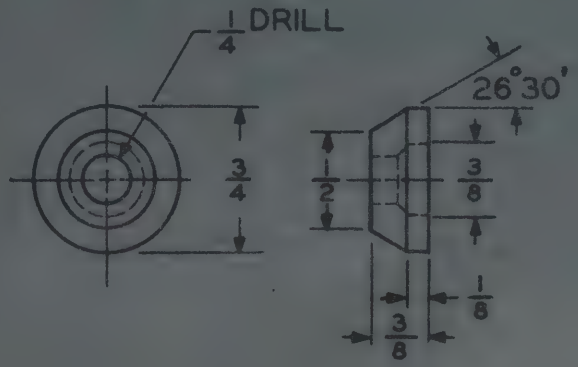
NOTE:
BREAK SHARP EDGES
FINISH ALL OVER

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.R.S.	PART NAME: ① BODY	
		C CLAMP	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD. 1	SCALE: FULL — SHEET 2 OF 3
		USED ON 112 A 1	DWG. NO. 112 A 2

NOTE:
BREAK SHARP EDGES
FINISH ALL OVER

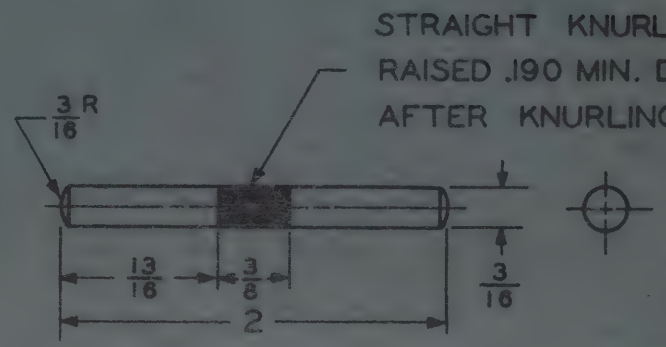
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE		MATERIAL C.R.S.		DO NOT SCALE THIS DRAWING
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTERLINE ±.003 ANGULAR: ±1° DECIMALS: ±.01 FRACTIONAL: ±1/64 DIMENSIONS TOLERANCES		HEAT TREAT	NO. REQD. 1	USED ON 1121 A1
		PART NAME ① C CLAMP	SCALE: FULL	SHEET 2 OF 3
				DWG. NO. 1121 A2



(2) BUTTON TIP

C.R.S. 1 REQ'D

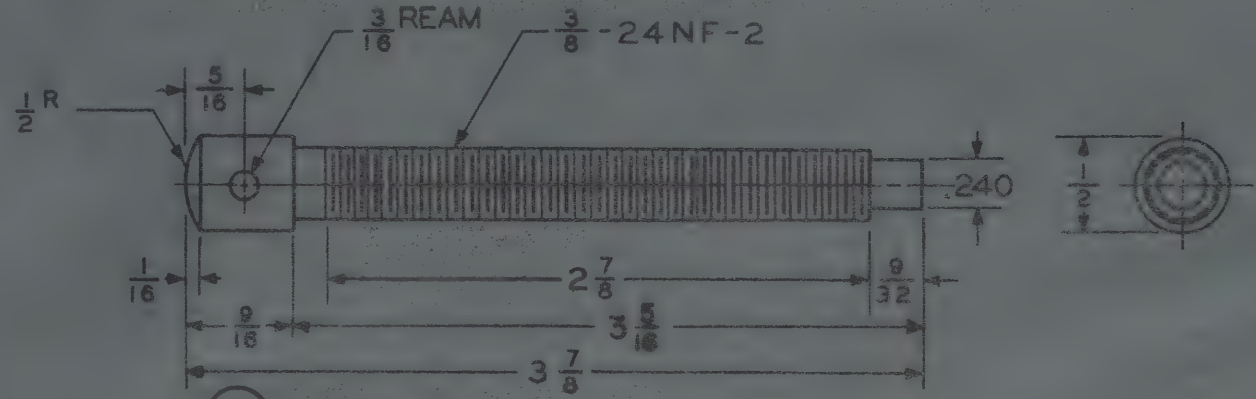
F.A.O.



(4) PIN

C.R.S. 1 REQ'D

F.A.O.



(3) SCREW

C.R.S. 1 REQ'D

F.A.O.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.R.S.	PART NAME: NO. 2, 3 & 4 C CLAMP	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT:	NO. REQD.	SCALE: FULL — SHEET 3 OF 3
		USED ON 112 A1	DWG. NO. 112 A 3

STRAIGHT KNURL,
RAISED .150 MIN. DIA
AFTER KNURLING
S
PIN
C.R.S. 1 REQ'D
F.A.O.
DRILL
BUTTON TIP
C.R.S. 1 REQ'D
F.A.O.
REAM
SCREW
C.R.S. 1 REQ'D
F.A.O.
DO NOT SCALE THIS DRAWING
NO. 2, 3 & 4
C CLAMP
SCALE: FULL
SHEET 3 OF 3
DWG. NO. 11SA3
USED ON 11SA1
MATERIAL
HEAT TREAT
PART NAME
PART NO. REQD.
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE
UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.03; ANGULAR 2°

HEAVY SERVICE C CLAMP

INTRODUCTORY INFORMATION:

The heavy service "C" clamp will stand the most rugged use found in the shop. It is a sturdy, well designed clamp yet does not have the appearance of excessive bulkiness. The design is good in proportion and is easy to layout. The outline drawing with tabular dimensioning provides a reasonable range in sizes. It is recommended that the screw be purchased, however, draw No. 113 A3 provides a set screw in a range of sizes for this heavy service "C" clamp.

STOCK:

One of each part, namely 113 A2 and 113 A3 C. R. steel.

ASSEMBLY PRECAUTIONS:

1. Inspect parts carefully to see that threads are mating properly.
2. Merely insert screw into body.
3. Final inspection, 100% as per drawing.

SAFETY AND PRECAUTIONS:

1. Observe all shop safety practices.

Item 1 - Body

STOCK:

C. R. S.

TOOLS:

12" Steel rule	1/4" Drill	6" Steel rule
Bastard file	3" Dividers	Fine mill file
Scriber	Tap drill (check tap chart)	Prick punch
Tap (see tabular drawing)	Layout dye	Hammer
		Tap wrench

PROCEDURES OR STEPS:

1. Cut off stock 1/16" oversize.
2. Apply layout dye to one side of piece.
3. Layout as per drawing.
4. Drill three 1/4" holes to form 1/8" radius fillets.
5. Saw approximately 1/64" on outside of lines.
6. Rough and finish file to lines.
7. Break all sharp edges.
8. Lay off tapped hole.
9. Drill and tap hole as per drawing.
10. Case harden.
11. Polish all over if desired.
12. Inspect 100% as per drawing.

Item 2 - Screw

STOCK:

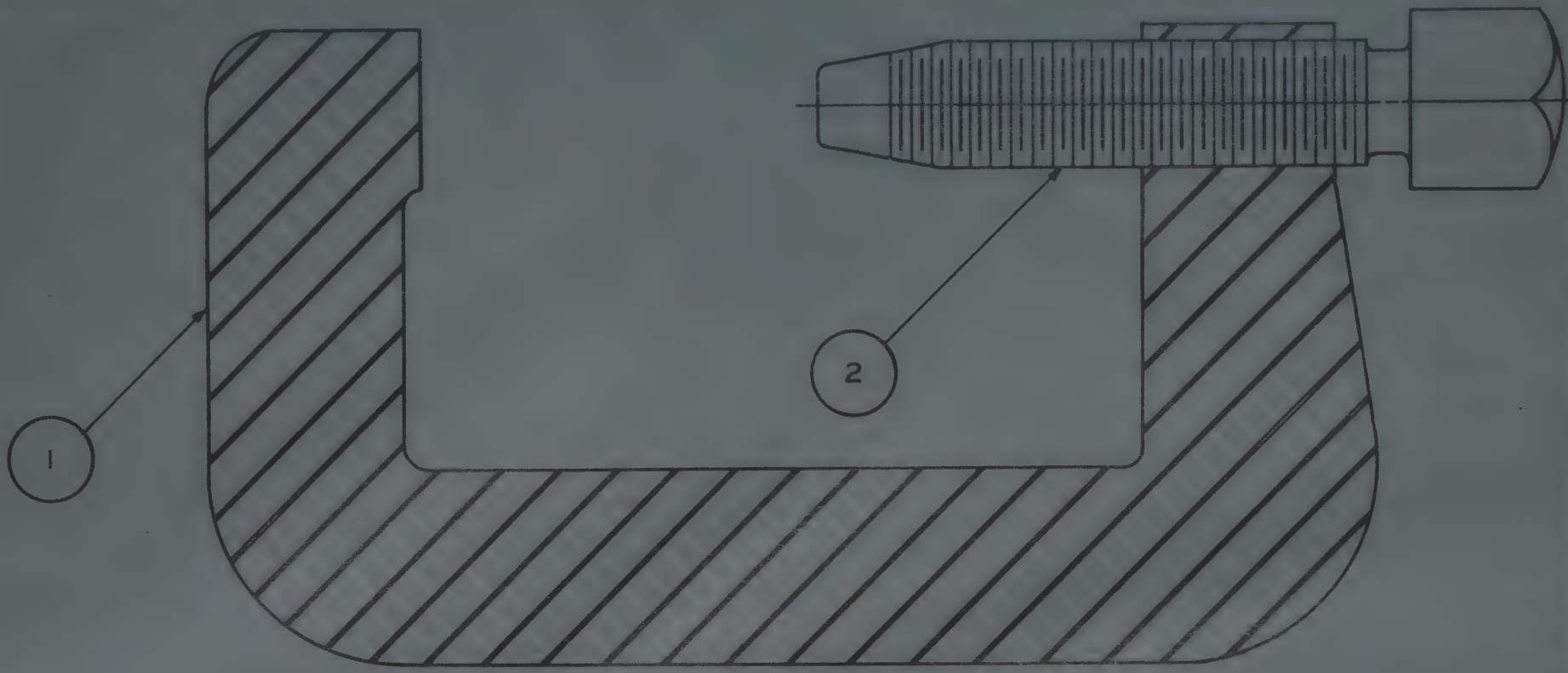
Square C. R. S. bar stock (if screw is not purchased)

TOOLS:

6" Steel rule	R. H. Turning tool	3" Outside caliper
Forming tool	1" Micrometer	Fine mill file
Necking tool	Thread gauge	Threading tool
60° Center gauge		Cutoff tool

PROCEDURES OR STEPS:

1. Hold square C. R. S. bar stock in collet or 4-way chuck and face end to clean up. Center drill one end.
2. Turn thread diameter. Leave 3/8" plus material on small end.
3. Turn taper on end.
4. Cut neck as per drawing.
5. Chase threads as per drawing.
6. Cut off center hole after threading.
7. Cut off to over all length.
8. Hold piece in collet on thread diameter and form radius on head end.
9. Case harden.
10. Inspect 100% as per drawing.



ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
2	1	A3	SCREW	C.R.S.	SEE CHART
1	1	A2	BODY	C.R.S.	SEE CHART

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

MATERIAL

HEAT TREAT

PART NAME: ASSEMBLY C-CLAMP
HEAVY SERVICE

NO. REQD. 1 | SCALE: FULL | SHEET 1 OF 3

USED ON | DWG. NO. 113 A 1

ITEM	QUANTITY	PART NUMBER	DESCRIPTION	MATL	SIZE
1	1	A2	BODY	C.R.S.	SEE CHART
2	1	A3	SCREW	C.R.S.	SEE CHART

HEAVY SERVICE C-CLAMP

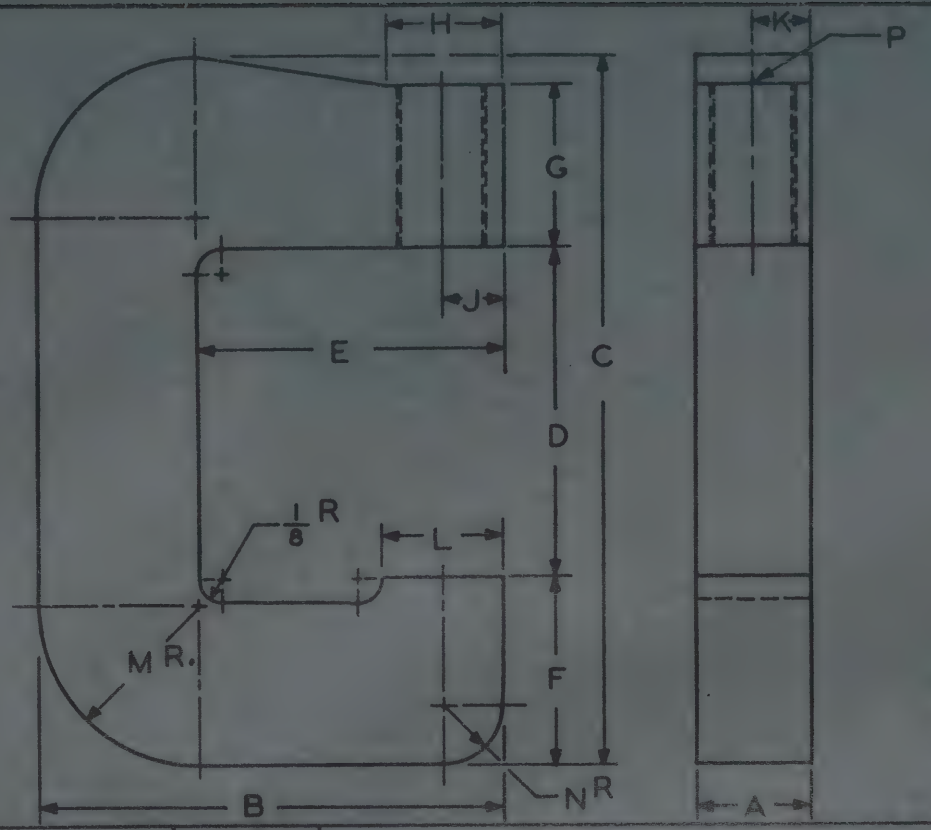
ASSEMBLY

DO NOT SCALE THIS DRAWING

NEXT ASSY	USED ON
APPLICATION	NO USED ON
HEAT TREAT	
FINISH	
MATERIAL	

DWG. NO.	REV
1134	
SCALE: FULL	SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: FRACTIONS ±1/64; DECIMALS .XX ±.03; .XXX ±.005
ANGULAR ±1°
THE CONFIDENTIAL AND PROPRIETARY INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF [illegible]. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF [illegible] IS PROHIBITED.



F. A. O.

REF. NO.	STOCK			OPENING		THROAT	OTHER DIMENSIONS								TAP
	A	B	C	D_{MAX}	D_{MIN}	E	F	G	H	J	K	L	M	N	P
1	1/2	1 1/2	2 1/2	3/4	0	11/16	7/8	3/4	1/2	1/4	1/4	1/2	3/4	1/4	3/8-16NC-2
2	1/2	2	3 1/4	1 1/4	0	1 1/8	1	7/8	1/2	1/4	1/4	1/2	7/8	1/4	3/8-16NC-2
3	5/8	2 5/8	3 7/8	1 3/4	3/4	1 5/8	1 1/8	1	5/8	5/16	5/16	5/8	1	5/16	1/2-13NC-2
4	7/8	3	4 3/4	2 1/4	7/8	1 7/8	1 1/4	1 1/8	7/8	7/16	7/16	7/8	1 1/8	7/16	5/8-11NC-2
5	1	4	6	3 1/4	1 3/8	2 3/4	1 3/8	1 1/4	1	1/2	1/2	1	1 1/4	1/2	3/4-10NC-2
6	1	4	7 3/8	4 1/2	2	2 3/4	1 3/8	1 1/4	1	1/2	1/2	1	1 1/4	1/2	3/4-10NC-2

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

MATERIAL: C.R.S.

HEAT TREAT: CASE HARDEN

PART NAME: ① BODY

C CLAMP, HEAVY SERVICE

NO. REQD. 1 | SCALE: FULL | SHEET 2 OF 3

USED ON 113A1 | DWG. NO. 113A2

F.A.O.

REF. NO.	STOCK A	STOCK B	STOCK C	OPENING D MAX	OPENING D MIN	THROAT E	OTHER DIMENSIONS F	OTHER DIMENSIONS C	OTHER DIMENSIONS H	OTHER DIMENSIONS J	OTHER DIMENSIONS K	OTHER DIMENSIONS L	OTHER DIMENSIONS M	OTHER DIMENSIONS N	TAP P
1	1/2	1 1/2	1 5/8	1/4	0	1 5/8	1 1/4	1 1/4	1	1	1	1	1	1	SAE 3/8
2	1 1/4	2	3 1/4	1 1/4	3/4	1 7/8	1 1/2	1 1/2	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	SAE 3/8
3	1 1/4	2 1/2	3 1/4	1 1/4	3/4	1 7/8	1 1/2	1 1/2	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	SAE 3/8
4	1 1/4	3	4 1/4	1 1/4	3/4	1 7/8	1 1/2	1 1/2	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	SAE 3/8
5	1 1/4	4	5	1 1/4	3/4	1 7/8	1 1/2	1 1/2	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	SAE 3/8

DO NOT SCALE THIS DRAWING

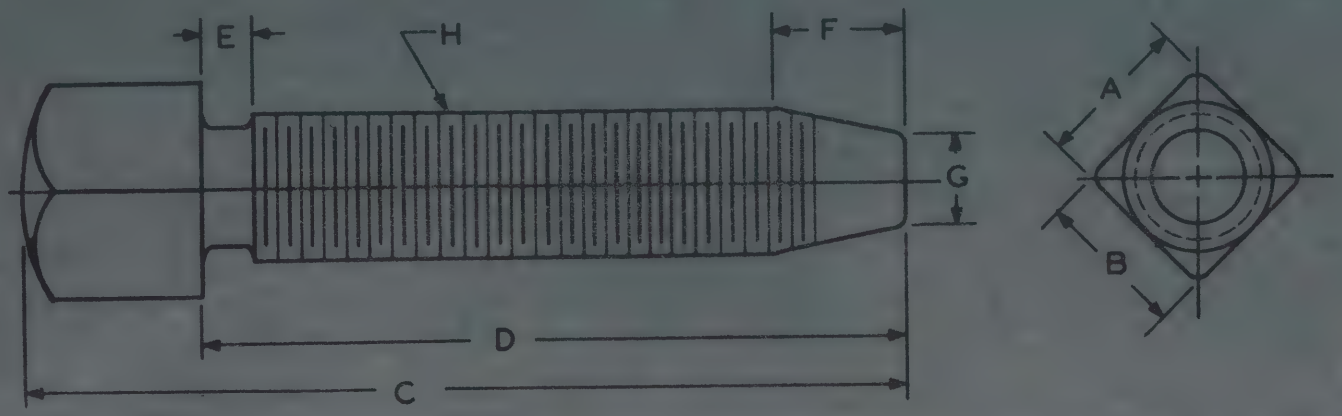
MATERIAL C.R.S.	HEAT TREAT CASE HARDEN	PART NO. STD.	SCALE: FULL	SHEET 2 OF 3
			DWG. NO. 113A1	

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

BODY CLAMP, HEAVY SERVICE

UNLESS OTHERWISE SPECIFIED ALL CENTER LINE DIMENSIONS WITHIN ±.005 OF TRUE CENTERS

DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.01; ANGULAR ±1°



REF. NO.	STOCK			OTHER DIMENSIONS				THREAD
	A	B	C	D	E	F	G	H
1	$\frac{3}{8}$	$\frac{3}{8}$	$1\frac{15}{16}$	$1\frac{1}{2}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{8}$-16NC-2
2	$\frac{3}{8}$	$\frac{3}{8}$	$2\frac{9}{16}$	$2\frac{1}{8}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{8}$-16NC-2
3	$\frac{1}{2}$	$\frac{1}{2}$	$2\frac{5}{8}$	2	$\frac{5}{32}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{1}{2}$-13NC-2
4	$\frac{5}{8}$	$\frac{5}{8}$	$3\frac{1}{4}$	$2\frac{1}{2}$	$\frac{3}{16}$	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{5}{8}$-11NC-2
5	$\frac{3}{4}$	$\frac{3}{4}$	4	$3\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$-10NC-2
6	$\frac{3}{4}$	$\frac{3}{4}$	$4\frac{5}{8}$	$3\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$-10NC-2

NOTE:
ITEM MAY BE PURCHASED AS "UNBRAKO" SQ. HD. CAP SCREW WITH TOOL POST POINT OR EQUAL

NOTE:
FINISH ALL OVER

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL: C.R.S.
HEAT TREAT:

PART NAME: ② SCREW
C CLAMP, HEAVY SERVICE
NO. REQD. 1 | SCALE: FULL | SHEET 3 OF 3
USED ON 113A1 | DWG. NO. 113A3

REF. NO.	STOCK			OTHER DIMENSIONS				THREAD
	A	B	C	D	E	F	G	H
1	$\frac{3}{8}$	$\frac{3}{8}$	$1\frac{1}{16}$	$1\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{8}$-16NC-2
2	$\frac{3}{8}$	$\frac{3}{8}$	$2\frac{9}{16}$	$1\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{8}$-16NC-2
3	$\frac{5}{8}$	$\frac{5}{8}$	$2\frac{5}{8}$	$1\frac{5}{8}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{5}{8}$-13NC-2
4	$\frac{5}{8}$	$\frac{5}{8}$	$2\frac{5}{8}$	$1\frac{5}{8}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{5}{8}$-11NC-2
5	$\frac{3}{4}$	$\frac{3}{4}$	4	$2\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$-10NC-2
6	$\frac{3}{4}$	$\frac{3}{4}$	$4\frac{1}{2}$	$2\frac{1}{4}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$-10NC-2

NOTE:

ITEM MAY BE PURCHASED AS "UNBRAKO" SQ. HD. CAP SCREW WITH TOOL POST POINT OR EQUAL

NOTE:

FINISH ALL OVER

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

				SCREW	
				MATERIAL C 8 S	
				TREAT HEAT	
DIMENSIONS ARE IN INCHES; TOLERANCES: FRACTIONAL ± 1/64; DECIMAL ± .003; ANGULAR ± 1°				NAME	PART
TRUE CENTERS WITHIN ± .003 OF CENTER LINE BETWEEN CENTERS OF ANY TWO HOLES				NO. REQD. 1	SCALE: FULL
DIMENSIONS SPECIFIED				USED ON 1194	DWG. NO. 1194 A 3

DO NOT SCALE THIS DRAWING

ANGLE CLAMP V BLOCK

INTRODUCTORY INFORMATION:

This V block is unique in design. The angle clamping arrangement is out of the way when holding round work while drilling, milling, and for layout work. It can also be used in pairs while machining long bars.

STOCK:

V block base is cast iron and clamps are C. R. steel.

SAFETY AND PRECAUTIONS:

1. Never lay measuring tools in dirty surroundings.
2. Always wear eye protection.
3. Keep sleeves rolled up above the elbows.
4. Make sure tools are sharp.
5. Clamp all work securely while machining.
6. Remove finger rings.
7. Observe all shop safety rules.

Item 1 - Base

STOCK:

Cast iron V-Block

TOOLS:

Steel rule	Bevel protractor	3/8" Drill
Combination square set	Layout dye	3/8" End mill
Center punch	5/16" Tap drill	Cut-off tool
Hammer	Tap wrench	10" Mill file
	3/8" - 16 NC tap	

PROCEDURES OR STEPS:

1. Secure the molded cast iron V Block.
2. Shape 1/8" off bottom.
3. Machine 1/8" off one side.
4. Lay out and machine opposite side to 3" wide.
5. Lay out side surface according to drawing.
6. Prick punch on lines lightly about 1/8" apart.
7. Shape one step end to layout lines.
8. Shape opposite step end to 3-1/2" and 4-1/2" width.
9. Rough out both V surfaces and top 45° angles.
10. Finish machining both V surfaces and top 45° angles.
11. Notch center of 45° V, 1/8" wide x 1/8" deep.
12. Lay out circles for two 3/8" screw holes.
13. Drill two 5/16" holes x 1" deep.
14. Tap two holes 3/8" - 16 NC for screws.
15. File all sharp corners.
16. Check work for sizes according to drawing.

Item 2 - Clamp

STOCK:

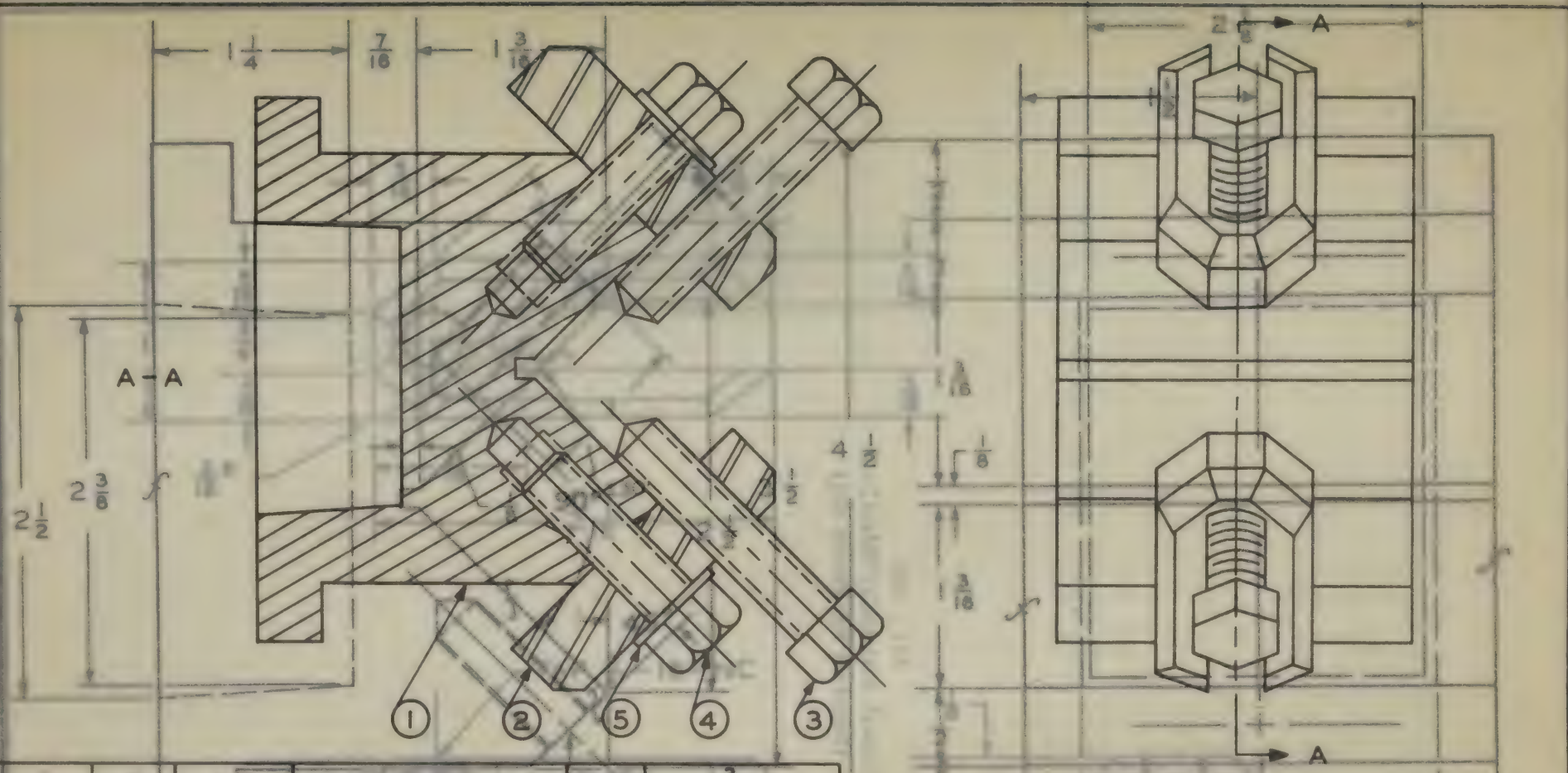
C. R. S.

TOOLS:

Steel rule	Hacksaw	5/16" Drill
Combination square set	File	3/8" - 16 NC tap
Scriber	Center punch	Tap wrench
Layout fluid	3/8" Drill	Hammer

PROCEDURES OR STEPS:

1. Select 1/2" x 1-1/8" x 2-5/8" C. R. steel.
2. Machine two sides to 1" wide.
3. Machine both ends to 2-1/2" length.
4. Lay out 3/8" slot, 45^{o} bevel edges and 3/8" screw hole.
5. Machine or file bevel 45^{o} beveled edges.
6. Drill end hole 3/8" and the rest of slot with 5/16" drill.
7. End mill or hack saw and file 3/8" slot to line.
8. Drill screw hole with 5/16" drill.
9. Tap hole 3/8" - 16 NC threads.
10. File all sharp edges.
11. Inspect as per drawing.



ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
5	2	A 1	WASHER	PUR.	3/8
4	2	A 1	HEX. HD. CAP SCR.	PUR.	3/8 x 1
3	2	A 1	HEX. HD. CAP SCR.	PUR.	3/8 x 2
2	2	A 3	CLAMP	M.S.	1 x 1/2 x 2 1/2
1	1	A 2	BASE	C.I.	4 1/2 x 2 7/8

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

MATERIAL C.I.

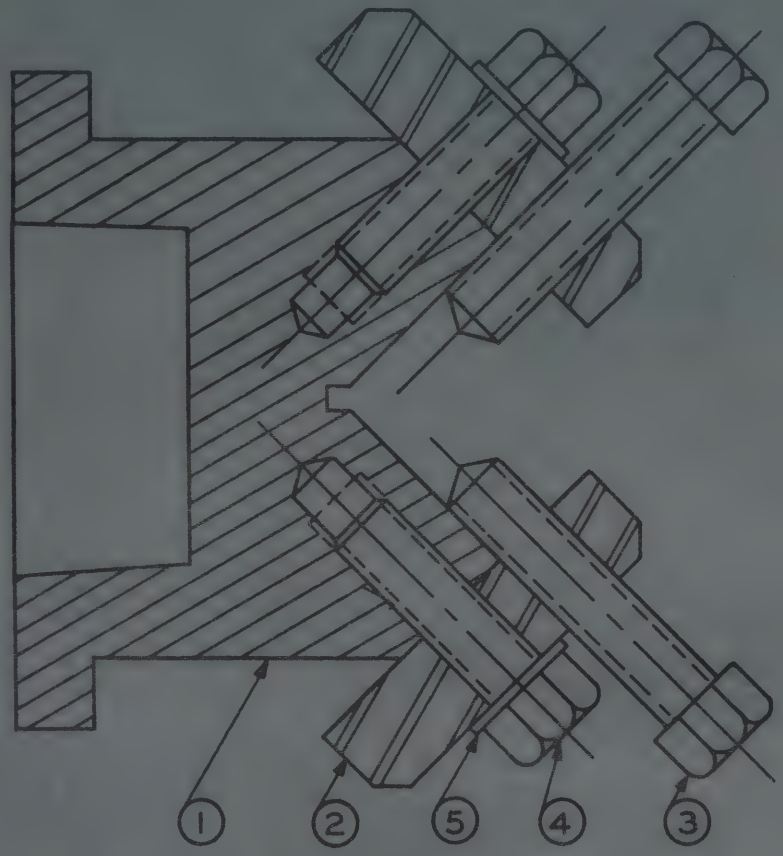
HEAT TREAT

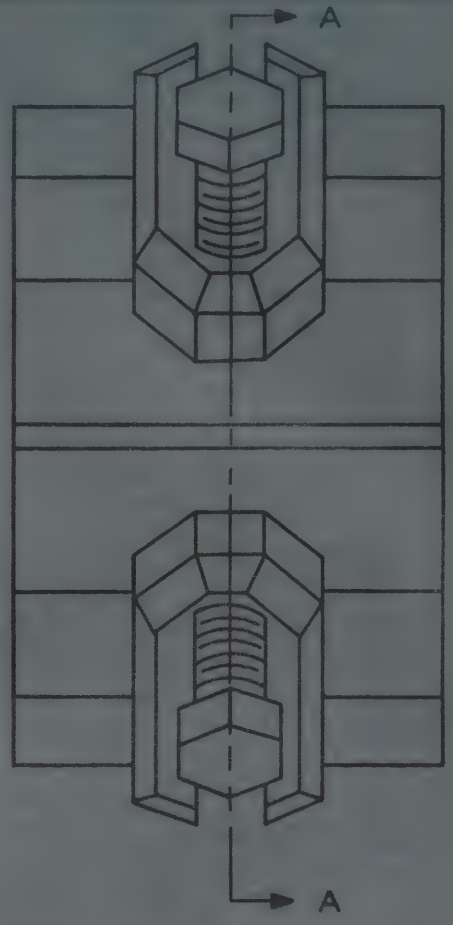
PART NAME: ASSEMBLY
ANGLE CLAMP V BLOCK

NO. REQD. | SCALE: 3/4 | SHEET 1 OF 3

USED ON | DWG. NO. 114 A 1

A–A





ITEM	REQD.	DWG. NO.	PART NAME	MATL	SIZE
5	2	A 1	WASHER	PUR.	$\frac{3}{8}$
4	2	A 1	HEX. HD. CAP SCR	PUR.	$\frac{3}{8}$ x 1
3	2	A 1	HEX. HD. CAP SCR.	PUR.	$\frac{3}{8}$ x 2
2	2	A 3	CLAMP	M.S.	1 x $\frac{1}{2}$ x $2\frac{1}{2}$
1	1	A 2	BASE	C.I.	$4\frac{1}{2}$ x $2\frac{7}{8}$

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL

HEAT TREAT

PART NAME: ASSEMBLY
ANGLE CLAMP V BLOCK

NO. REQD. | SCALE: 3/4 | SHEET 1 OF 3

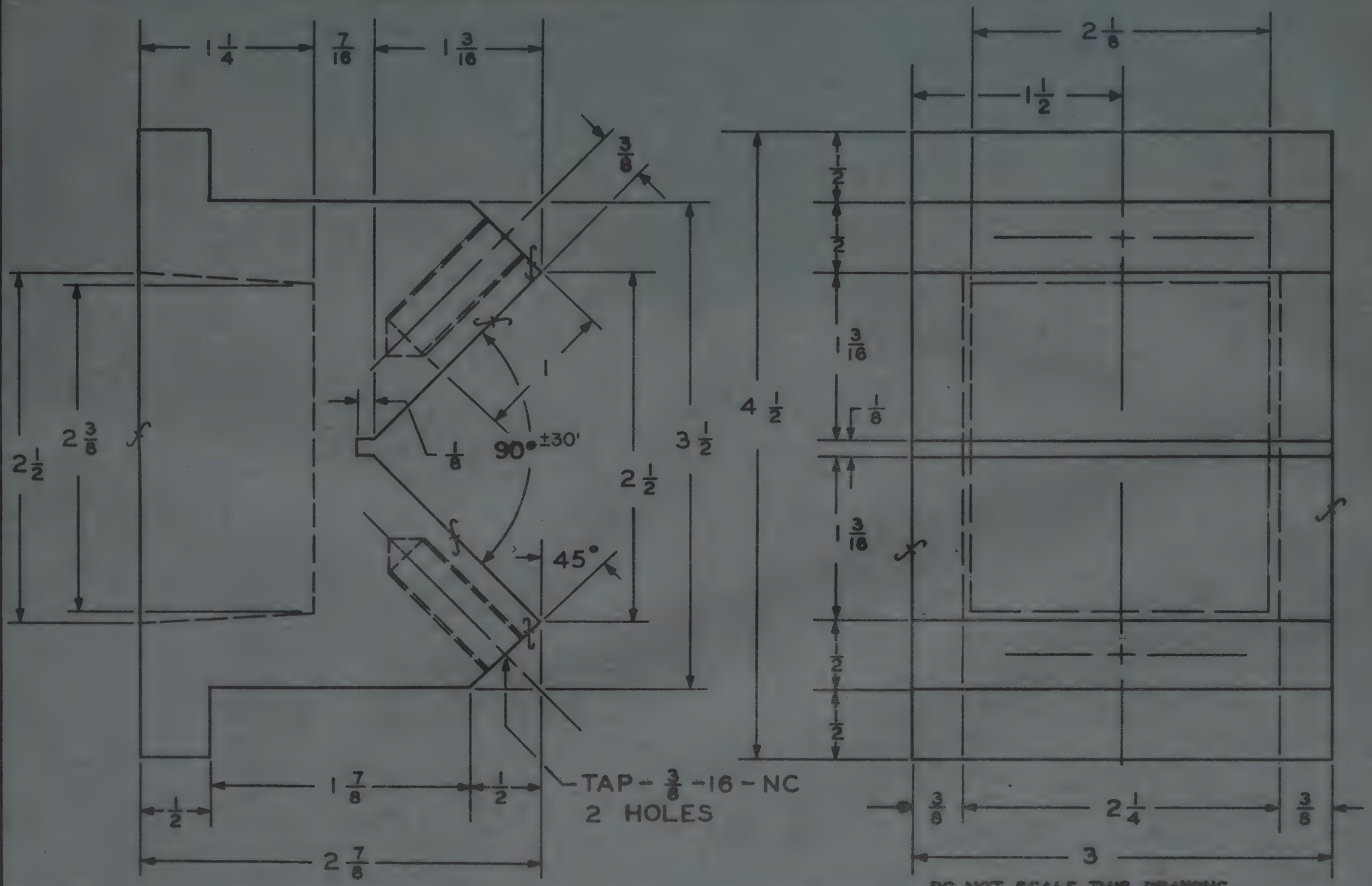
USED ON | DWG. NO. 114 A 1

ITEM	REQD.	DWG. NO.	PART NAME	MATL	SIZE
5	2	A 1	WASHER	PUR.	$\frac{3}{8}$
4	2	A 1	HEX. HD. CAP SCR	PUR.	$\frac{3}{8}$ x 1
3	2	A 1	HEX. HD. CAP SCR	PUR.	$\frac{3}{8}$ x $\frac{3}{8}$
2	2	A 3	CLAMP	M.S.	1 x $\frac{1}{4}$ x $2\frac{1}{8}$
1	1	A 2	BASE	C.I.	$4\frac{1}{2}$ x $2\frac{1}{8}$

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN $\pm .003$ OF CENTER LINE. CONCENTRICITY $\pm .001$
DIMENSIONAL TOLERANCES : FRACTIONAL $\pm \frac{1}{64}$; DECIMAL $\pm .003$; ANGULAR $\pm 2°$

MATERIAL		DO NOT SCALE THIS DRAWING
HEAT TREAT		USED ON
NO. REQD.	PART NAME	ANGLE CLAMP V BLOCK
SCALE: 3/4		ASSEMBLY
DWG. NO.		SHEET 3 OF 3
A 1		A 4



DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	NO. ① BASE
	C. I.		ANGLE CLAMP V BLOCK
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD. 1	SCALE: FULL SHEET 2 OF 3
		USED ON 114 A 1	DWG. NO. 114 A 2

THE OHIO TOOL CO.

SERVICE INDUSTRIAL EDGEWOOD AVENUE

V BLOCK CLAMP ANGLE

NAME	NO.
BASE	①

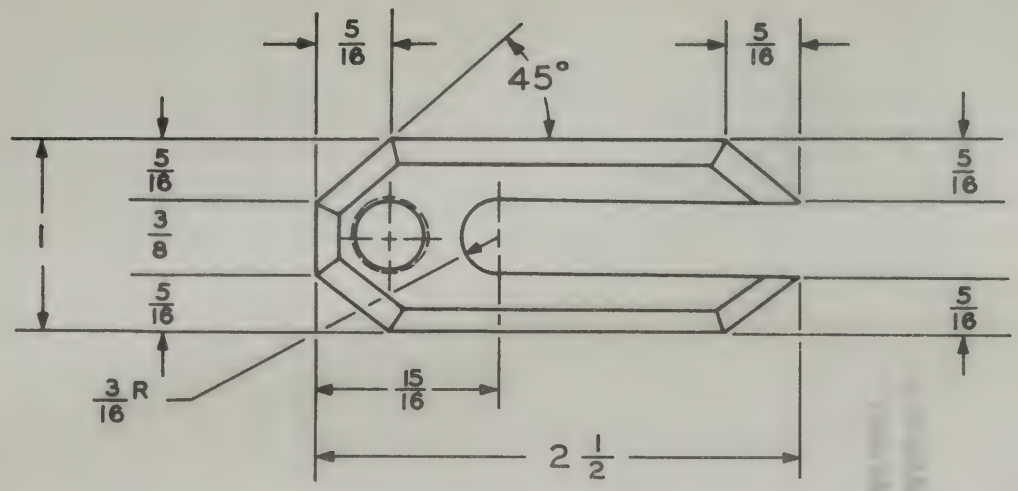
SCALE: FULL	SHEET 2 OF 3
DWG. NO. A-11-A-1	

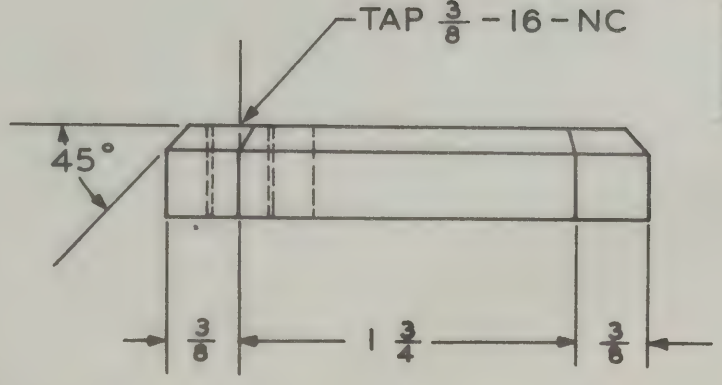
USED ON A-11-A-1

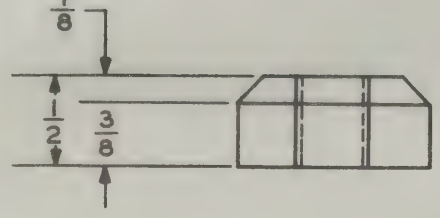
MATERIAL	
HEAT TREAT	C.I.

DO NOT SCALE THIS DRAWING

DIMENSIONAL TOLERANCES: FRACTIONAL ± 1/64; DECIMAL ± .005; ANGULAR ± 30'
TAPPED HOLES TO BE CENTER LINE CONSTRUCTION ± .001
CUTTER CLEARANCE AS REQUIRED.







NOTE: F. A. O.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL M. S.	PART NAME	NO. ② CLAMP ANGLE CLAMP V BLOCK
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD. 2	SCALE: FULL SHEET 3 OF 3
		USED ON 114 A 1	DWG. NO. 114 A 3

DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR ±1°.

SURFACE FINISH 125 MICRO-INCH OR BETTER UNLESS OTHERWISE SPECIFIED.

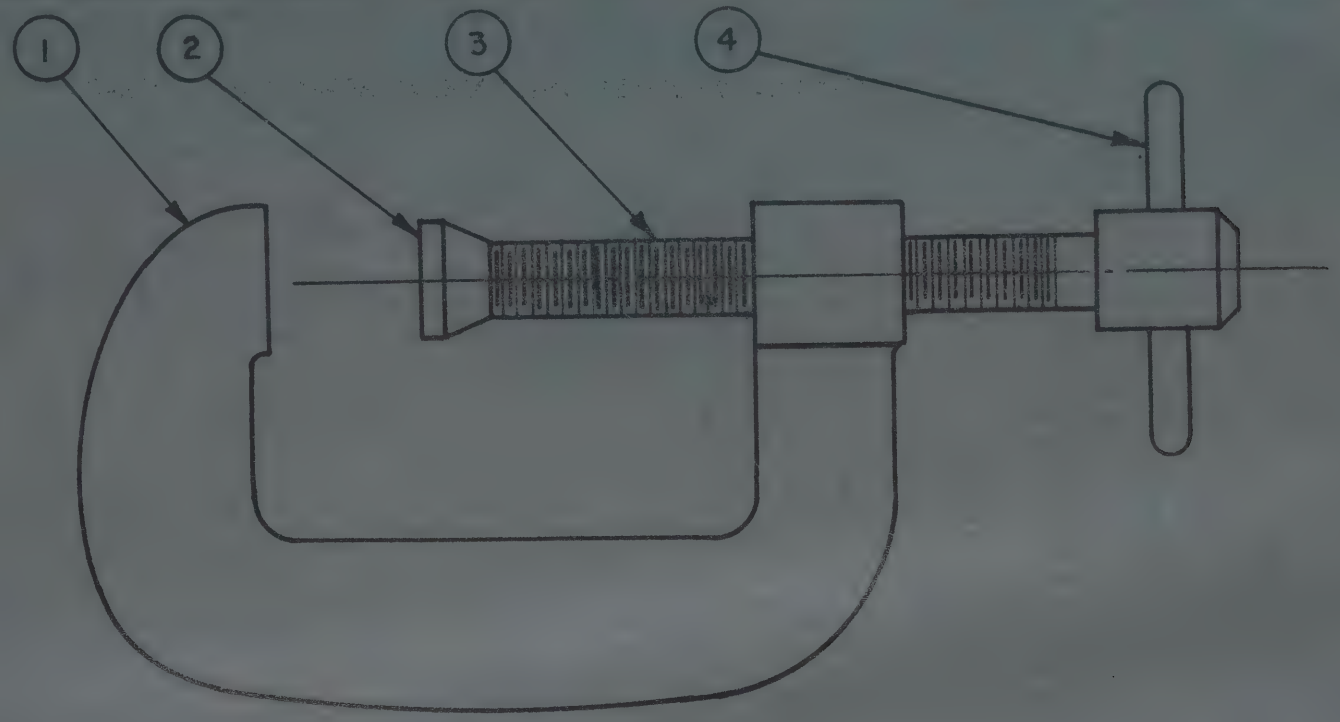
ALL CENTERS WITHIN ±.003 OF TRUE POSITION. CONCENTRICITY .001 TIR.

THE OHIO FORGE AND INDUSTRIAL EQUIPMENT SERVICE

HEAT TREAT		NAME	ANGLE CLAMP BLOCK	USED ON	DWG. NO.
TARGET	M.S.	TOL.	NO. REQD. 2	SCALE: FULL	SHEET 3 OF 3

DO NOT SCALE THIS DRAWING

Job - 115
C-CLAMP (Cast iron frame)
(Job sheets not included)



ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
4	1	A3	PIN	C.R.S.	$\frac{3}{16}$ D. X 2
3	1	A3	SCREW	C.R.S.	$\frac{5}{8}$ D. X $4\frac{7}{16}$
2	1	A3	BUTTON TIP	C.R.S.	$\frac{5}{8}$ D. X $\frac{3}{8}$
1	1	A2	BODY	C.I.	$\frac{1}{2}$ X $2\frac{11}{16}$ X $4\frac{1}{4}$

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES. FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL

HEAT TREAT

PART NAME: C-CLAMP

NO. REQD.

SCALE: FULL

SHEET 1 OF 3

USED ON

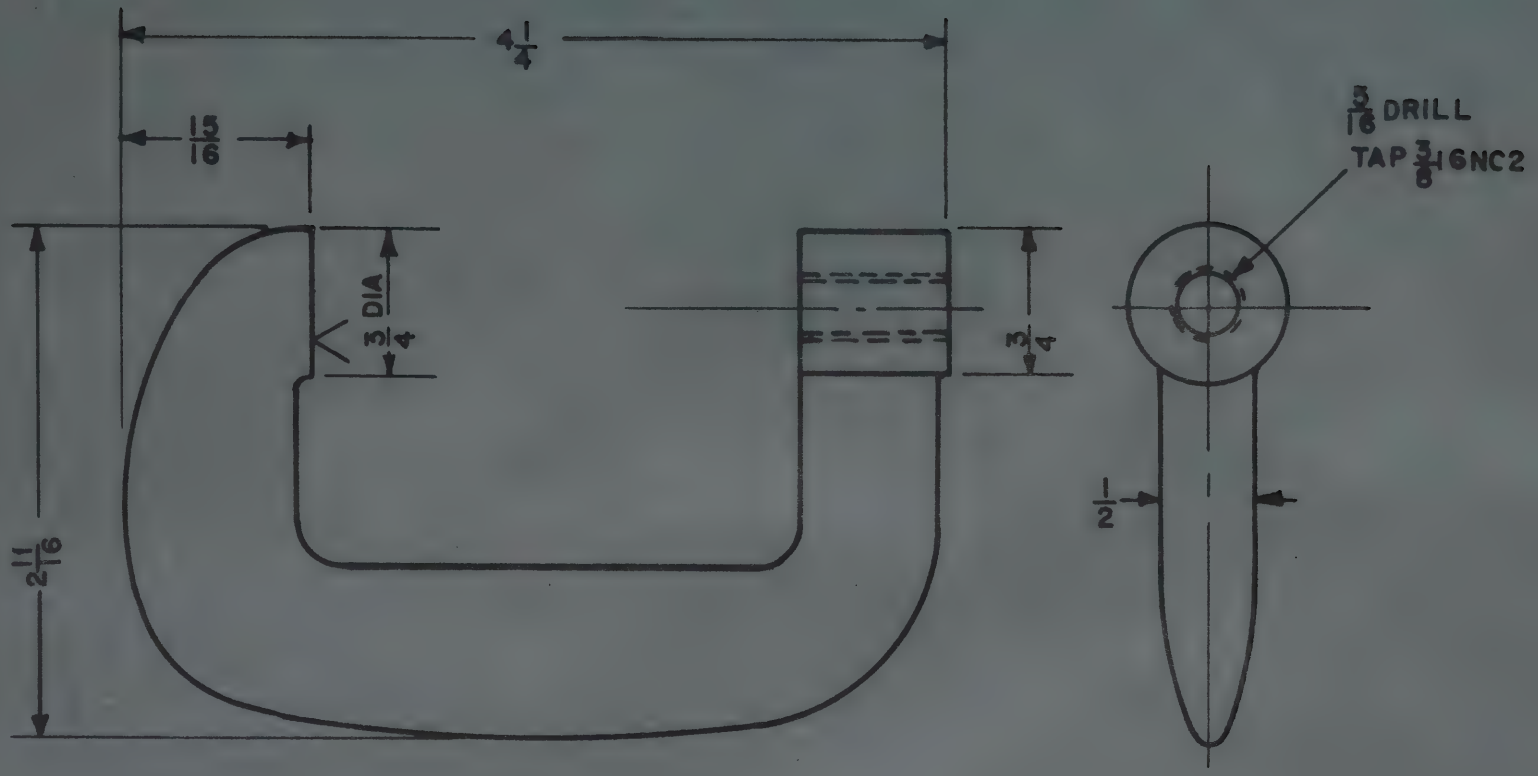
DWG. NO. 115A1

ITEM	REQD.	DWG. NO. PART NAME	MATL.	SIZE
4	1	A3 PIN	C.R.S.	$\frac{3}{16}$D. x S
3	1	A3 SCREW	C.R.S.	$\frac{5}{8}$D. x $4\frac{7}{16}$
2	1	A3 BUTTON TIP	C.R.S.	$\frac{5}{8}$D. x $\frac{3}{8}$
1	1	A2 BODY	CI.	$\frac{1}{2}$T x 2$\frac{1}{2}$ x $4\frac{1}{4}$

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL		DO NOT SCALE THIS DRAWING
HEAT TREAT	PART NAME	C-CLAMP
USED ON	NO. REQD.	SCALE: FULL SHEET 1 OF 3
		DWG. NO. IISA1



DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C1	PART NAME: ○ BODY	
		C-CLAMP	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES. FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT:	NO. REQD. 1	SCALE: FULL / SHEET 2 OF 3
		USED ON 115A1	DWG. NO. 115A2

DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.005; ANGULAR ½°
TRUE CENTERS WITHIN ±.003 OF CENTER LINE CONCENTRICITY ±.001
UNLESS OTHERWISE SPECIFIED:

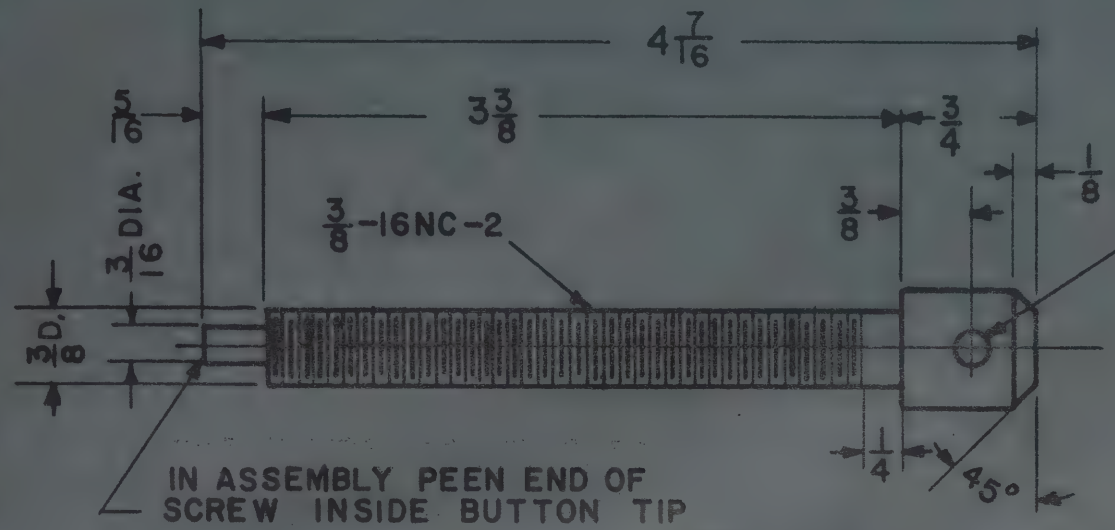
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

HEAT TREAT		USED ON #112 A1	
C1	MATERIAL	NO. REQD 1	SCALE: HALF
	NAME TRAM	O-CLAMP	
	O BODY		

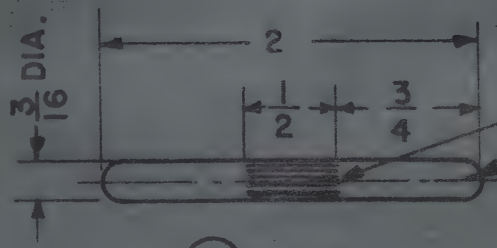
DO NOT SCALE THIS DRAWING

SHEET 5 OF 9

DWG. NO. 112 A1 5

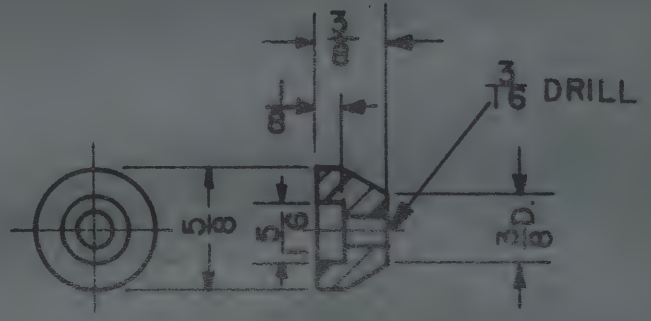


(3) SCREW
C.R.S 1 REQ'D.
F.A.O



STRAIGHT KNURL
RAISE .190 MIN. DIA.
AFTER KNURLING

(4) PIN
C.R.S. 1 REQ'D.
F. A.O.



(2) BUTTON TIP
C.R.S 1 REQ'D.
F.A.O.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL C.R.S.	PART NAME	NO (2)(3)(4) C-CLAMP
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES. FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL SHEET 3 OF 3
		USED ON 115 A1	DWG. NO. 115 A3

BEAM
SCREW
C.R.S.
1 REQ'D.
F.A.O.
STRAIGHT KNURL
AFTER KNURLING
PIN
C.R.S.
1 REQ'D.
F.A.O.
BUTTON TIP
C.R.S.
1 REQ'D.
F.A.O.
DRILL
DIA.
S-1 3/8 LONG
IN ASSEMBLY BEEN BUTTON TIP
SCREW
DIA.

PARALLEL CLAMP

INTRODUCTORY INFORMATION:

Parallel clamps are used extensively in the machine shop to hold two or more pieces together while machining, drilling, filing or laying out lines. The two jaws must be parallel to each other and tightened on the work by the clamping screw.

STOCK:

Cold rolled steel.

SAFETY AND PRECAUTIONS:

1. When drilling the two jaws, they must be drilled in pairs so the holes will line up.

2. When tapping the large screw holes the threads must be perpendicular to the top surface.

3. Threads on the screws should be cut on a lathe, not by use of dies.

4. Observe all shop safety rules.

Item 1 - Clamping Screw

STOCK:

C. R. S.

TOOLS:

Center drill	Drill for handle in screw
Micrometer	Drill chuck
File	

PROCEDURES OR STEPS:

1. Secure cold rolled steel according to chart.
2. Place bar in lathe collet.
3. Face one end and center drill.
4. Support work with center (allow 3/8" to cut out center).
5. Turn out side dia. of thread according to dimension L.
6. Turn small pilot end as per dimension H. Turn radius K.
7. Knurl head, medium knurl.
8. Cut threads in lathe to size L.
9. Cut off head to proper length D.
10. Machine or crown head with file and polish.
11. Layout hole on knurled head J.
12. Drill hole in head, holding screw in V block.
13. Cut off 3/8" center end, bevel end as per drawing.
14. Case harden all over.

Item 2 - Adjusting Screw

STOCK:

C. R. S.

TOOLS:

Center drill
Thread center gage
File
Drill for handle in screw
Drill chuck

PROCEDURES OR STEPS:

1. Secure C. R. Steel according to chart.
2. Place bar in lathe collet.
3. Face one end and center drill.
4. Support work with lathe center (allow 3/8" to cut out center).
5. Turn outside diameter of thread as per drawing J.
6. Turn A diameter and notch H groove.
7. Medium knurl head.
8. Cut threads on lathe to drawing size J.
9. Cut off head to proper length D.
10. Machine or file crown on head and polish.
11. Layout hole G on knurled head.
12. Drill hole in knurled head, holding screw in V block.
13. Cut-off 3/8" center end, round end with file.
14. Case harden all over.

Item 3 - Threaded Jaw

STOCK:

C. R. S.

TOOLS:

Layout fluid
Center punch
Combination square set
Tap drill
Tap
File
Hammer

PROCEDURES OR STEPS:

1. Select square C. R. Steel according to chart.
2. Square both ends.
3. Lay out two tapped holes.
4. Shape bevel to F length.
5. Drill two screw holes with the proper tap drill.
6. Tap two threaded holes according to drawing.
7. Machine or file large radius on rounded end.
8. Draw file and polish all over.
9. Case harden all over.

Item 4 - Loose Jaw

STOCK:

C. R. S.

TOOLS:

Layout fluid
Center punch
Countersink
Tap drill and tap
File
Hammer

PROCEDURES OR STEPS:

1. Select square C. R. Steel according to chart.
2. Cut off and square both ends to proper length.
3. Lay out holes and angle as per drawing.
4. Shape bevel to F. length.
5. Transfer J blind hole from Threaded Jaw on drawing 116 A4.
6. Transfer K screw hole from Threaded Jaw on drawing 116 A4.
7. Countersink K hole as per chart.
8. Drill and tap L hole as per chart.
9. Machine or file large radius on rounded end.
10. Draw file and polish all over.
11. Case harden all over.

Item 5 - Straight Clip

STOCK:

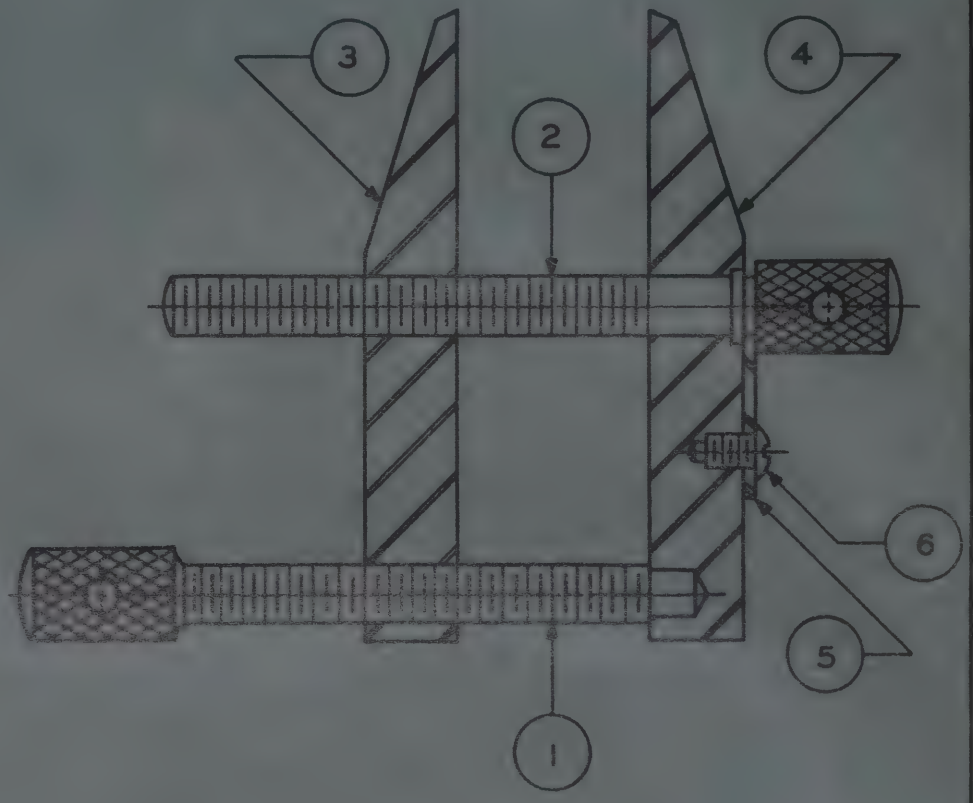
C. R. S.

TOOLS:

Layout fluid
Center punch
Drill for hole G
File
Hammer

PROCEDURES OR STEPS:

1. Select 1/16" soft sheet steel.
2. Layout and saw or cut to drawing size.
3. Drill hole G as per drawing.
4. File radius H and F as per chart.
5. File all sharp corners and polish.



ITEM	REQD.	DWG.NO.	PART NAME	MATL.	SIZE
6	1	—	RD.HD.MACH.SCR	PUR.	8-32 x $\frac{1}{4}$
5	1	A6	STRAIGHT CLIP	C.R.S.	——
4	1	A5	LOOSE JAW	C.R.S.	——
3	1	A4	THREADED JAW	C.R.S.	——
2	1	A3	ADJUSTING SCREW	C.R.S.	——
1	1	A2	CLAMPING SCREW	C.R.S.	——

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL

HEAT TREAT

PART NAME: ASSEMBLY PARALLEL CLAMP

NO. REQD. 1 | SCALE FULL | SHEET 1 OF 6

USED ON | DWG. NO. 116 A 1

ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
6	—	RD.HD.MACH.SCR.	PUR.	C.R.S.	8-32 x $\frac{1}{2}$
5	1	A6	STRAIGHT CLIP	C.R.S.	—
4	1	A5	LOOSE JAW	C.R.S.	—
3	1	A4	THREADED JAW	C.R.S.	—
2	1	A3	ADJUSTING SCREW	C.R.S.	—
1	1	A2	CLAMPING SCREW	C.R.S.	—

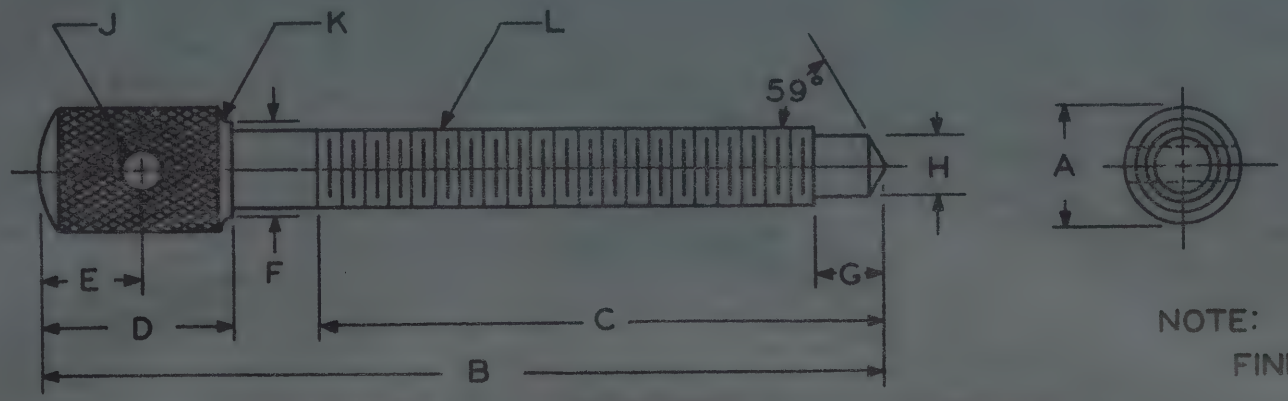
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

PARALLEL CLAMP ASSEMBLY

DO NOT SCALE THIS DRAWING

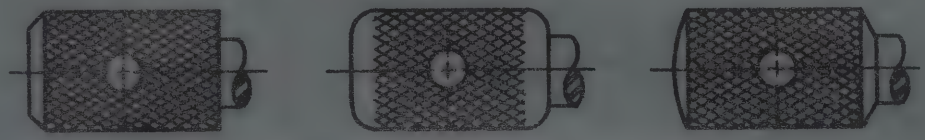
		HEAT TREAT	NO. REQD. 1	SCALE: FULL SIZE
			PART NAME	SHEET 1 OF 1
				DWG. NO. 1 A 1

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN DECIMALS OF AN INCH
100± VISUAL INSPECTION ONLY
5° MACHINING TOLERANCES: FRACTIONAL ±1/64 DECIMAL ±.03
DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1982



NOTE:
FINISH ALL OVER

NOTE:
BREAK SHARP EDGES



ALTERNATE DESIGNS FOR KNURLED END

REF NO	STOCK		OTHER DIMENSIONS									JAW OPENING
	A	B	C	D	E	F	G	H	J	K	L	
1	$\frac{5}{16}$	$2\frac{3}{32}$	$1\frac{1}{4}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{1}{4}$	$\frac{5}{32}$	.120	$\frac{1}{8}$	$\frac{1}{32}$ R	10-24NC-2	1
2	$\frac{3}{8}$	$2\frac{13}{16}$	$1\frac{13}{16}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{7}{32}$	.180	$\frac{1}{8}$	$\frac{1}{32}$ R	$\frac{1}{4}$-20NC-2	$1\frac{1}{2}$
3	$\frac{1}{2}$	$3\frac{5}{8}$	$2\frac{3}{8}$	$\frac{7}{8}$	$\frac{7}{16}$	$\frac{3}{8}$	$\frac{9}{32}$	.240	$\frac{3}{16}$	$\frac{1}{16}$ R	$\frac{5}{16}$-18NC-2	2
4	$\frac{5}{8}$	$4\frac{7}{16}$	$2\frac{15}{16}$	1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{11}{32}$	.300	$\frac{3}{16}$	$\frac{1}{16}$ R	$\frac{3}{8}$-16NC-2	$2\frac{1}{2}$
5	$\frac{3}{4}$	$5\frac{3}{4}$	4	$\frac{1}{8}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{7}{16}$	.360	$\frac{1}{4}$	$\frac{1}{16}$ R	$\frac{1}{2}$-13NC-2	$3\frac{1}{2}$

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL: C.R.S.
HEAT TREAT: CASE HARDEN

PART NAME: ① CLAMPING SCREW
PARALLEL CLAMP

NO. REQD 1 | SCALE FULL | SHEET 2 OF 6
USED ON 116 A 1 | DWG. NO. 116 A 2

DIMENSIONS ARE IN INCHES. TOLERANCES: FRACTIONAL ± 1/64; DECIMAL .X ± .03; .XX ± .010; ANGULAR ± 1°. UNLESS OTHERWISE SPECIFIED.

MATERIAL: C.R.S.	HARDEN CASE	USED ON 1811	DWG. NO. 1811 A
FINISH: CLEAR ①	PART NAME	NO. REQ'D 1	SCALE: FULL SHEET 2 OF 2

PARALLEL CLAMP

WEBER CLAMPING SCREW

DO NOT SCALE THIS DRAWING

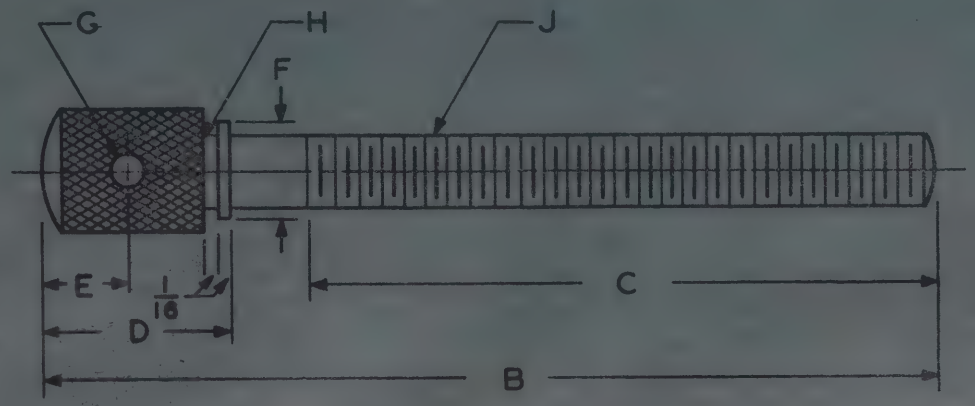
REF NO.	STOCK			OTHER DIMENSIONS							JAW OPENING
	A	B	C	D	E	F	G	H	J	K	L
1	$\frac{5}{8}$	$\frac{3}{32}$ S	$1\frac{1}{4}$	$\frac{2}{8}$	$\frac{2}{8}$	$\frac{1}{4}$	$\frac{2}{32}$	150.	$\frac{1}{8}$	$\frac{R}{32}$	$10\text{-}24\text{NC-S}$
2	$\frac{3}{8}$	$\frac{13}{16}$ S	$1\frac{1}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{2}{16}$	$\frac{7}{32}$	180.	$\frac{1}{8}$	$\frac{R}{16}$	$\frac{1}{4}\text{-}20\text{NC-S}$
3	$\frac{1}{2}$	$2\frac{5}{8}$ S	$\frac{5}{8}$	1	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{9}{32}$	240.	$\frac{1}{8}$	$\frac{R}{16}$	$\frac{5}{16}\text{-}18\text{NC-S}$
4	$\frac{5}{8}$	$4\frac{1}{16}$ S	$2\frac{1}{2}$	$1\frac{1}{8}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{11}{32}$	300	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{3}{8}\text{-}16\text{NC-S}$
5	$\frac{3}{4}$	$5\frac{3}{4}$	$3\frac{1}{4}$	$1\frac{3}{8}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{7}{16}$	360.	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{7}{16}\text{-}13\text{NC-S}$

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

ALTERNATE DESIGNS FOR KNURLED END

BREAK SHARP EDGES

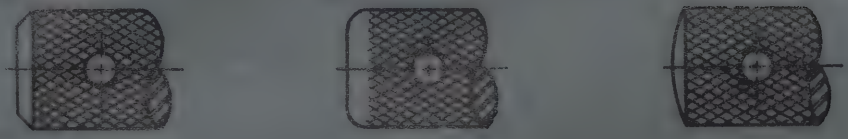
NOTE:
REMOVE ALL BURRS AND FINISH





NOTE:
FINISH ALL OVER

NOTE:
BREAK SHARP EDGES



ALTERNATE DESIGNS FOR KNURLED END

REF NO	STOCK			OTHER DIMENSIONS						
	A	B	C	D	E	F	G	H	J	JAW OPENING
1	5/16	2 1/4	1 3/8	5/8	1/4	7/32	1/8	3/16 DIA.	10-24NC-2	1
2	3/8	3	2	3/4	5/16	9/32	1/8	1/4 DIA.	1/4-20NC-2	1 1/2
3	1/2	3 7/8	2 5/8	7/8	3/8	3/8	3/16	5/16 DIA.	5/16-18NC-2	2
4	5/8	4 3/4	3 1/4	1	7/16	1/2	3/16	3/8 DIA.	3/8-16NC-2	2 1/2
5	3/4	6 1/8	4 3/8	1 1/8	1/2	5/8	1/4	1/2 DIA.	1/2-13NC-2	3 1/2

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

MATERIAL: C.R.S.	PART NAME	② ADJUSTING SCREW	
		PARALLEL CLAMP	
HEAT TREAT: CASE HARDEN	NO. REQD. 1	SCALE: FULL	SHEET 3 OF 6
	USED ON 116 A 1		DWG. NO. 116 A 3

NOTE:
FINISH ALL OVER

ALTERNATE DESIGNS FOR KNURLED END

NOTE:
BREAK SHARP EDGES

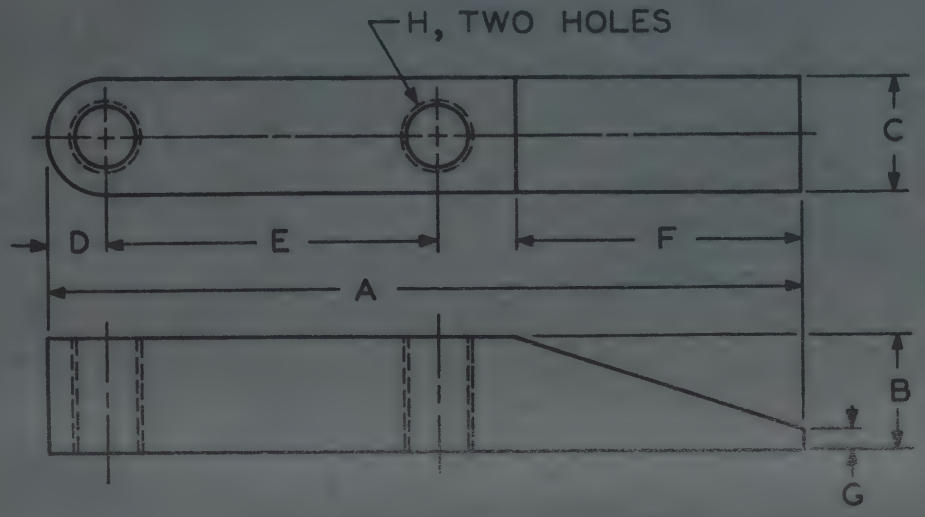
REF NO	STOCK		OTHER DIMENSIONS						
	A	B	C	D	E	F	G	H	J
1	$\frac{5}{16}$	$2\frac{1}{4}$	$1\frac{3}{8}$	$\frac{5}{8}$	$\frac{1}{4}$	$\frac{7}{32}$	$\frac{1}{8}$	$\frac{3}{16}$ DIA.	10-24NC-2
2	$\frac{3}{8}$	3	2	$\frac{3}{4}$	$\frac{5}{16}$	$\frac{9}{32}$	$\frac{1}{8}$	$\frac{1}{4}$ DIA.	$\frac{1}{4}$-20NC-2
3	$\frac{1}{2}$	$3\frac{1}{8}$	$2\frac{5}{8}$	$1\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$	$\frac{5}{16}$ DIA	$\frac{5}{16}$-18NC-2
4	$\frac{5}{8}$	$4\frac{1}{4}$	$3\frac{1}{4}$	1	$\frac{1}{16}$	$\frac{1}{2}$	$\frac{3}{16}$	$\frac{3}{8}$ DIA	$\frac{3}{8}$-16NC-2
5	$\frac{3}{4}$	$5\frac{1}{8}$	$4\frac{3}{8}$	$1\frac{1}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{4}$	$\frac{1}{2}$ DIA	$\frac{1}{2}$-13NC-2

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

MATERIAL	PART NAME	ADJUSTING SCREW PARALLEL CLAMP
C.R.S.	NO. 8000	SCALE: FULL SHEET 3 OF 6
HEAT TREAT CASE HARDEN	USED ON 116 A1	DWG. NO. 116 A 3

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE CONSISTENTLY +.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.03; ANGULAR 2°





ALTERNATE JAW DESIGNS

REF NO	STOCK			OTHER DIMENSIONS				
	A	B	C	D	E	F	G	H
1	$2\frac{1}{8}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{32}$	1	$\frac{3}{4}$	$\frac{1}{16}$	10-24NC-2
2	$2\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{16}$	$1\frac{1}{4}$	1	$\frac{3}{32}$	$\frac{1}{4}$-20NC-2
3	$3\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$\frac{1}{8}$	$\frac{5}{16}$-18NC-2
4	4	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{16}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$\frac{5}{32}$	$\frac{3}{8}$-16NC-2
5	5	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{8}$	$2\frac{3}{8}$	$1\frac{3}{4}$	$\frac{3}{16}$	$\frac{1}{2}$-13NC-2

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

MATERIAL: C.R.S.

HEAT TREAT: CASE HARDEN

PART NAME: ③ THREADED JAW PARALLEL CLAMP

NO. REQD. 1 | SCALE: FULL | SHEET 4 OF 6

USED ON 116 A 1 | DWG. NO. 116 A 4

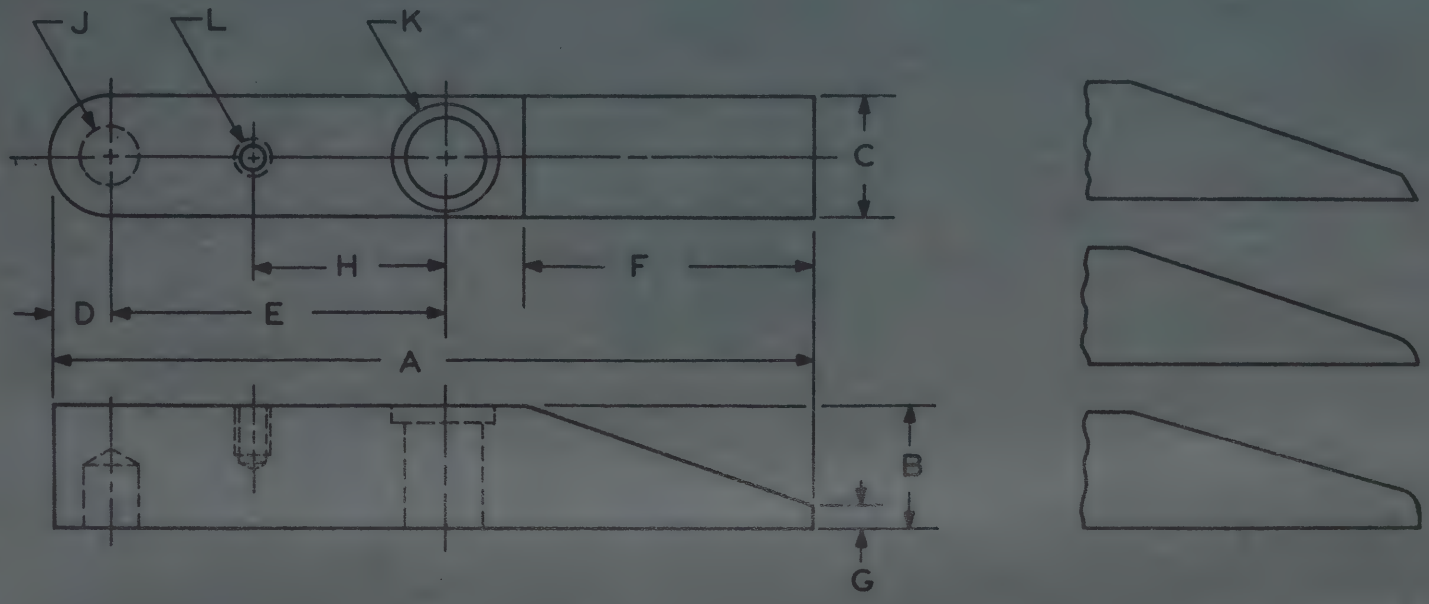
ALTERNATE JAW DESIGNS

REF NO	STOCK			OTHER DIMENSIONS			
	A	B	C	D	E	F	G	H
1	2 1/8	2/16	2/16	2/32	1	3/4	1/16	10-24NC-2
2	2 3/4	3/8	3/8	3/16	1 1/4	1	3/32	1/4-20NC-2
3	3 3/8	1/2	1/2	1/4	1 1/2	1 1/4	1/8	5/16-18NC-2
4	4	5/8	5/8	2/16	1 3/4	1 1/2	2/32	3/8-16NC-2
5	5	3/4	3/4	3/8	2 3/8	1 3/4	1/16	1/2-13NC-2

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE		MATERIAL C.R.S.	PART NAME
③ THREADED JAW PARALLEL CLAMP		HEAT TREAT CASE HARDEN	NO. REQD. 1
	SCALE: FULL	SHEET 4 OF 6	
	USED ON 118 A1	DWG. NO. 118 A4	

UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OR CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°



REF. NO.	STOCK			OTHER DIMENSIONS							
	A	B	C	D	E	F	G	H	J	K, C'BORE	L
1	$2\frac{1}{8}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{32}$	1	$\frac{3}{4}$	$\frac{1}{16}$	$\frac{1}{2}$	$\frac{1}{8}$ DIA x $\frac{5}{32}$ DEEP	$\frac{7}{32}$ DIA $\frac{1}{4}$ x $\frac{3}{32}$ DEEP	6-32 NC x $\frac{3}{16}$ DEEP
2	$2\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{16}$	$1\frac{1}{4}$	1	$\frac{3}{32}$	$\frac{3}{4}$	$\frac{3}{16}$ DIA x $\frac{3}{16}$ DEEP	$\frac{9}{32}$ DIA $\frac{5}{16}$ x $\frac{3}{32}$ DEEP	6-32 NC x $\frac{3}{16}$ DEEP
3	$3\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$ DIA x $\frac{1}{4}$ DEEP	$\frac{11}{32}$ DIA $\frac{7}{16}$ x $\frac{3}{32}$ DEEP	8-32 NC x $\frac{5}{16}$ DEEP
4	4	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{16}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$\frac{5}{32}$	1	$\frac{5}{16}$ DIA x $\frac{5}{16}$ DEEP	$\frac{13}{32}$ DIA $\frac{9}{16}$ x $\frac{3}{32}$ DEEP	8-32 NC x $\frac{5}{16}$ DEEP
5	5	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{8}$	$2\frac{3}{8}$	$1\frac{3}{4}$	$\frac{3}{16}$	1	$\frac{3}{8}$ DIA x $\frac{3}{8}$ DEEP	$\frac{17}{32}$ DIA $\frac{11}{16}$ x $\frac{3}{32}$ DEEP	8-32 NC x $\frac{5}{16}$ DEEP

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ± $\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL	PART NAME	④ LOOSE JAW
C. R. S.		PARALLEL CLAMP
HEAT TREAT	NO. REQD. 1	SCALE: FULL
CASE HARDEN	USED ON 116 A 1	DWG. NO. 116 A 5

SHEET 5 OF 6

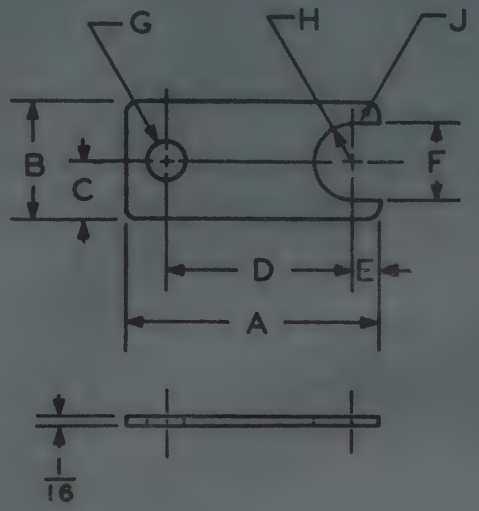
REF. NO.	STOCK			OTHER DIMENSIONS						
	A	B	C	D	E	F	G	H	J	K, C'BORE	L
1	2 1/8	2 1/16	2 5/16	2 5/32	1	3/4	1 1/8	1 5/8	1/8 DIA x 3/32 DEEP	7/32 DIA x 1/4 x 3/32 DEEP	6-32NC x 3/16 DEEP
2	2 3/4	2 3/8	2 5/16	2 5/32	1 1/4	1	1 3/32	1 5/8	3/16 DIA x 3/32 DEEP	9/32 DIA 1/8 x 3/32 DEEP	8-32NC x 3/16 DEEP
3	3 3/8	2 5/8	2 5/16	2 1/4	1 5/8	1 1/4	1 1/8	2 1/4	1/4 DIA x 1/4 DEEP	11/32 DIA 1/4 x 1/4 DEEP	8-32NC x 1/4 DEEP
4	4	2 5/8	2 5/8	2 1/8	1 3/4	1 5/8	1 5/16	2 3/4	5/16 DIA x 3/8 DEEP	13/32 DIA 5/16 x 3/8 DEEP	10-32NC x 3/8 DEEP
5	5	3 1/4	3 1/4	2 3/8	2 3/8	1 3/4	1 5/8	3 3/8	3/8 DIA x 1/2 DEEP	13/32 DIA 5/16 x 3/8 DEEP	10-32NC x 3/8 DEEP

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

MATERIAL	PART NAME	LOOSE JAW
C.R.S.		PARALLEL CLAMP
HEAT TREAT CASE HARDEN	NO. REQD. 1	SCALE: FULL SHEET 5 OF 6
USED ON 116 A 1		DWG. NO. 116 A 5

UNLESS OTHERWISE SPECIFIED: SURFACE FINISH 125 ; TRUE CENTERS WITHIN ±.005 OF CENTERLINE ; DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64 ; DECIMAL ±.003 ; ANGULAR 2°



NOTE: BREAK ALL SHARP EDGES

REF. NO.	STOCK		OTHER DIMENSIONS						
	A	B	C	D	E	F	G	H	J
1	3/4	5/16	5/32	1/2	1/16	7/32	.149 DIA	7/64 R	1/32 R
2	1	3/8	3/16	3/4	1/16	9/32	.149 DIA	9/64 R	1/32 R
3	1 1/8	1/2	1/4	3/4	1/8	11/32	.177 DIA	11/64 R	1/16 R
4	1 3/8	5/8	5/16	1	1/8	13/32	.177 DIA	13/64 R	1/16 R
5	1 3/8	3/4	3/8	1	1/8	17/32	.177 DIA	17/64 R	1/16 R

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

MATERIAL: C.R.S.

HEAT TREAT:

PART NAME: ⑤ STRAIGHT CLIP
PARALLEL CLAMP

NO. REQD. 1 | SCALE: FULL | SHEET 6 OF 6

USED ON 116 A1 | DWG. NO. 116 A 6

NOTE: BREAK ALL SHARP EDGES

REF. NO.	STOCK		OTHER DIMENSIONS					
	A	B	C	D	E	F	G	H	J
1	3/4	5/16	5/32	1/2	1/16	7/32	.149DIA	7/64 R	1/32 R
2	1	3/8	3/16	3/4	1/16	9/32	.149DIA	9/64 R	1/32 R
3	1 1/8	1/2	1/4	3/4	1/8	11/32	.177DIA	11/64 R	1/16 R
4	1 3/8	5/8	5/16	1	1/8	13/32	.177DIA	13/64 R	1/16 R
5	1 3/8	3/4	3/8	1	1/8	17/32	.177DIA	17/64 R	1/16 R

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

MATERIAL	PART NAME	STRAIGHT CLAMP
C.R.S.		PARALLEL CLAMP
HEAT TREAT	NO. REQD. 1	SCALE: FULL SHEET 6 OF 6
	USED ON 116 A1	DWG. NO. 116 A6

BENCH BLOCK

INTRODUCTORY INFORMATION:

The bench block contains lathe, drill press, bench layout and shaper operations and is very useful for drill press work, knocking out pins and bench assembly.

STOCK:

Carbon Tool Steel

SAFETY AND PRECAUTIONS:

1. Clamp work secure while drilling.
2. Use oil while drilling holes.
3. Roll sleeves up above the elbows.
4. Neck ties must be tucked into shirt.
5. Never wear gloves while working on machines.
6. Observe all shop safety rules.

Bench Block

STOCK:

T. S.

TOOLS:

6" Steel rule	Layout dye	Hammer
4" Caliper	Combination square set	1/8" - 5/32" - 3/16"
Center drill	4" Dividers	7/32" - 1/4" - 5/16"
Knurling tool	Center punch	3/8" - 1/2" - 5/8" Dri
10" Mill file		

PROCEDURES OR STEPS:

1. Select tool steel 3-1/8" dia. x 1-5/8" long.
2. True work in lathe chuck and face one side.
3. Center drill.
4. Drill 9/16" hole (pilot hole).
5. Drill 39/64" through the 9/16" hole. (Back up the 39/64" drill to keep it running true.
6. Use 5/8" machine reamer, run slow, use oil.
7. Bore inside cavity to 2" and 15^{O} wall x 1" deep.
8. Place on lathe mandrel.
9. Turn out side dia. to 3".
10. Face opposite side to 1-1/2" thick.
11. Medium knurl O. S. diameter.
12. File all sharp edges.
13. Cover top surface with layout dye.
14. Layout complete as per drawing.

Bench Block (Continued)

PROCEDURES OR STEPS: (Continued)

15. Center drill all holes.

16. Drill all holes as per drawing.

17. Ream all holes as per drawing.

18. Shape or mill 90° V.

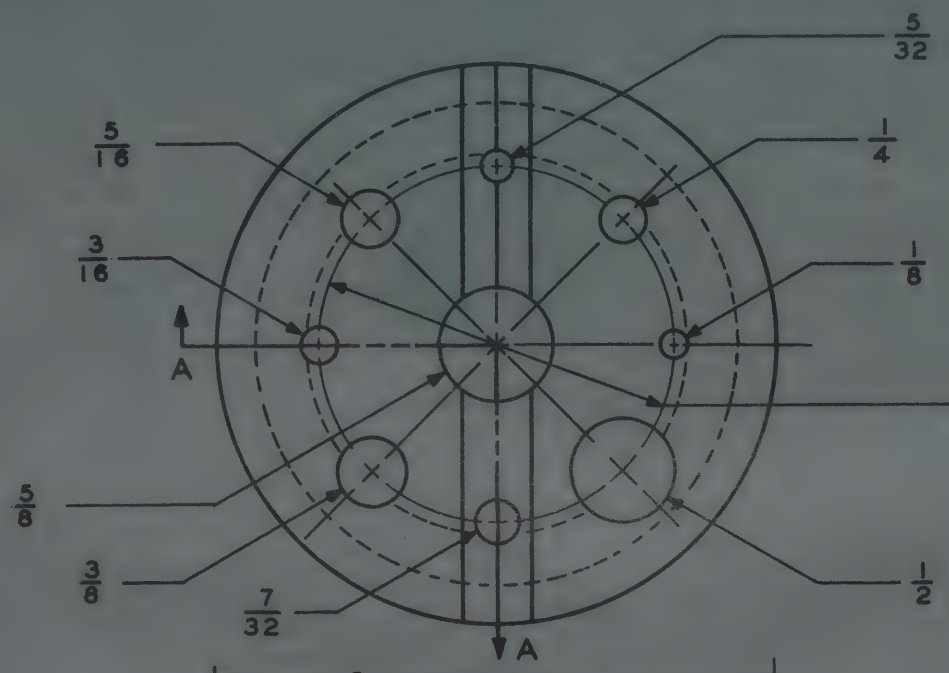
19. File all burrs and polish.

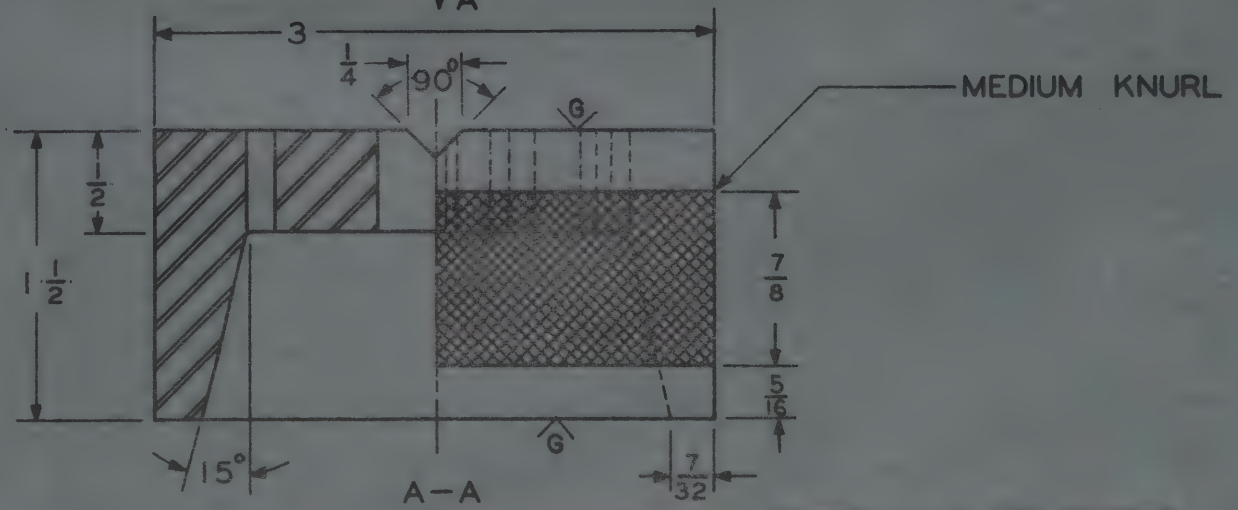
20. Inspect as per drawing.

21. Harden and draw temper.

22. Surface grind top and bottom.

NOTE:
REAM ALL HOLES
TO SIZE INDICATED





DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: T.S.	PART NAME: BENCH BLOCK	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT: HARDEN & DRAW	NO. REQD. 1	SCALE: FULL / SHEET 1 OF 1
		USED ON	DWG. NO. 117 A 1

NOTE:
REAM ALL HOLES
TO SIZE INDICATED

8 HOLES
B.C. 1 1/8

A—A

MEDIUM KNURL

DO NOT SCALE THIS DRAWING

		DRAWN	USED ON		DWG. NO. 117 A
		CHECKED	NO. REQD. 1	SCALE: FULL	SHEET 1 OF 1
		TRACED	NAME		
		TABS			
		JABSTRAM	BENCH BLOCK		

THE OHIO TOOL EDUCATIONAL INDUSTRIAL SERVICE

DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.005; ANGULAR 5°
TAPER CENTERS WITHIN ±.003 TO CENTER LINE. CONCENTRICITY ±.001
UNLESS OTHERWISE SPECIFIED:

TRAMMEL POINTS

INTRODUCTORY INFORMATION:

This tool is practical as a beam compass or as dividers for drawing arcs or circles. It can be used for inside and outside dimensions by substituting caliper legs for divider points or a pencil can be inserted and used on the drawing board.

STOCK:

Point holders are brass.
Scriber and caliper points are drill rod.
Beam is cold rolled steel.

SAFETY AND PRECAUTIONS:

1. Wear eye protection.
2. Roll sleeves above elbows.
3. Grind negative rake on all tools for brass.
4. Never shift tools in lathe tool post while machines are operating.
5. Observe all shop safety rules.

Item 1 - Leg

STOCK:

Brass

TOOLS:

Steel rule	19/64" Drill	Tap wrench
Center drill	5/16" Reamer	O. D. Caliper
Center punch	Scriber	File and emery cloth
23/64" Drill	3/8" Reamer	Hammer
10-32 NF Tap		#9 Drill

PROCEDURES OR STEPS:

1. Secure 3/4" Dia. x 3-3/8" long brass, two required.
2. Place in lathe collet, face both ends, observe total length of 3-5/16".
3. Center drill on end.
4. Drill 19/64" hole x 1" deep.
5. Ream 5/16" hole x 1" deep.
6. Bevel end 1/4" x 45°.
7. Place other end in collet.
8. Turn 5/8" ball and radius as per drawing.
9. Chase 3/4" - 16 NF threads.
10. File and polish all over.
11. Lay out cross hole 3/8" and 10-32 NF hole.
12. Drill 23/64" hole in leg.
13. Ream 3/8" hole.
14. Drill with #9 drill for 10-32 NF screw in leg.
15. Thread hole with 10-32 NF tap.
16. File and polish all over.

Item 2 - Beam

STOCK:

C. R. S.

TOOLS:

36" Rule
File
Emery cloth

PROCEDURES OR STEPS:

1. Secure 3/8" dia. x 28" long C. R. S.
2. Chuck in lathe collet and file round ends.
3. Polish 3/8" bar.
4. Machine 1/32" flat on entire length of beam.
5. Draw file and polish flat surface.

Item 3 - Binding Nut

STOCK:

Brass

TOOLS:

Steel rule
Center drill
1/2" Drill
11/16" Drill
3/4" - 16 NF tap
Tap wrench
File

PROCEDURES OR STEPS:

1. Secure 1-1/4" dia. x 4" long, brass.
2. Chuck true in lathe chuck.
3. Face one end.
4. Center drill, support work with tail stock center.
5. Knurl outside diameter, medium knurl 3/4" long.
6. Drill 1/2" hole x 3/4" deep. (Pilot hole)
7. Drill with 11/16" drill 3/4" deep.
8. Tap 3/4" - 16 NF threads, support tap with tail center.
9. Cut off 2 pieces 1/4" long. Bevel edges with file.
10. Bevel edges of tapped holes with file or scraper.
11. Clean burrs out of threads with 3/4" - 16 NF tap.

Item 4 - Point Lock Screw

STOCK:

Brass

TOOLS:

1" Micrometer	Hand die
Steel rule	File

PROCEDURES OR STEPS:

1. Select 1/2" dia. x 2" long, brass, two screws required.
2. Chuck true in lathe chuck.
3. Face one end.
4. Turn 3/16" dia. x 3/8" long.
5. File or turn 45^{o} bevel on end of screw.
6. Cut threads with hand die, 3/16" - 32 NF.
7. Knurl.
8. Cut-off knurled head 3/16" long, bevel edges with file.

Item 5 - Divider Point

STOCK:

Drill Rod

TOOLS:

Steel rule
File

PROCEDURES OR STEPS:

1. Secure 5/16" x 3" long drill rod, two required.
2. Machine or file taper to point 1" long.
3. Bevel opposite end with file.
4. Polish all over.
5. Harden and draw temper, 3/8" on point end.

Item 5A - Caliper Point

STOCK:

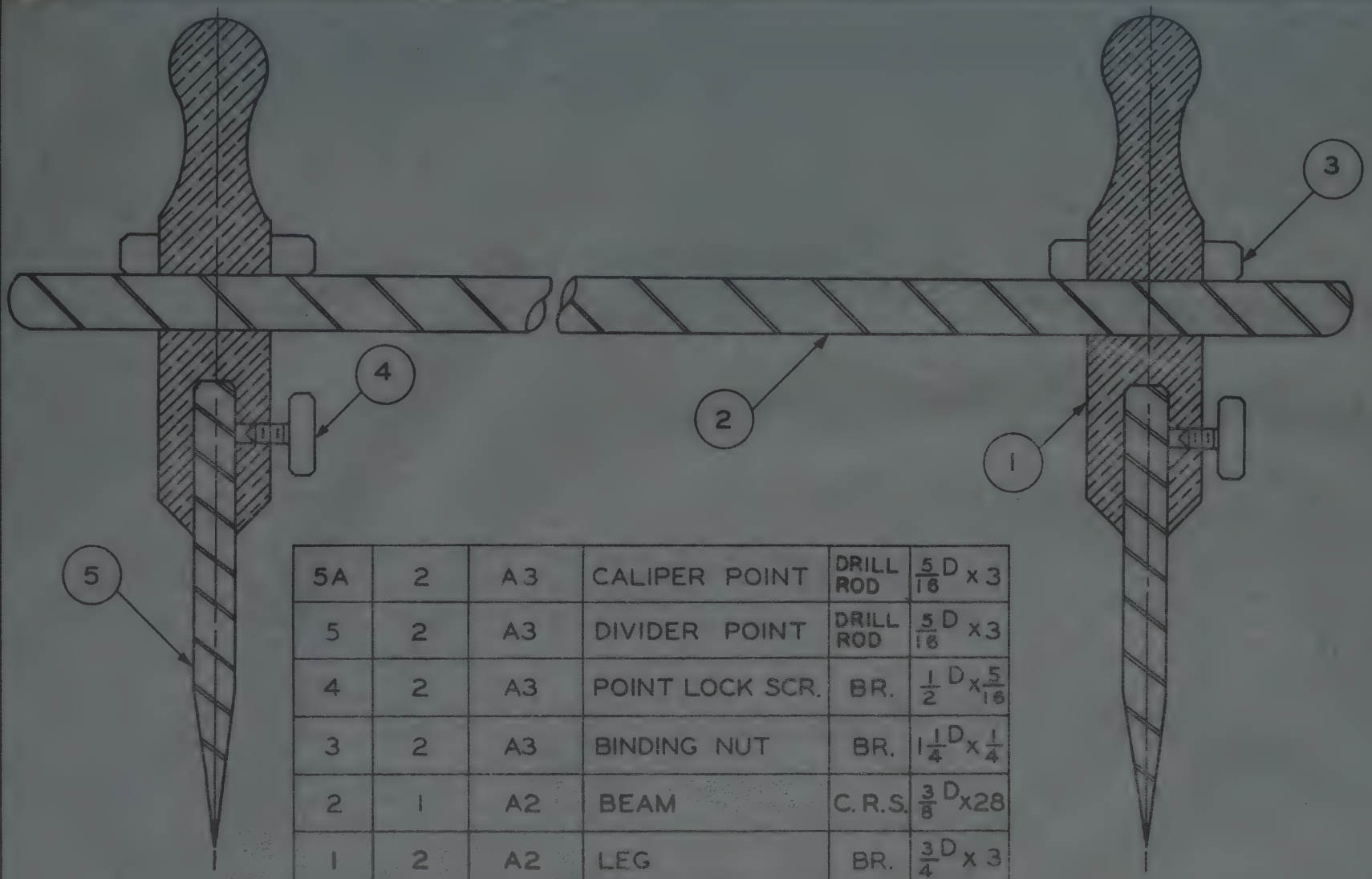
Drill Rod

TOOLS:

Steel rule
File
Emery cloth

PROCEDURES OR STEPS:

1. Secure 5/16" dia. 3" long, drill rod, two required.
2. Machine or file taper 1" long, round end.
3. Bevel opposite end with file.
4. Polish all over.
5. Bend taper end as per drawing.
6. Harden and draw temper, 3/8" on small end.



ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
5A	2	A3	CALIPER POINT	DRILL ROD	$\frac{5}{16}$D x 3
5	2	A3	DIVIDER POINT	DRILL ROD	$\frac{5}{16}$D x 3
4	2	A3	POINT LOCK SCR.	BR.	$\frac{1}{2}$D x $\frac{5}{16}$
3	2	A3	BINDING NUT	BR.	$1\frac{1}{4}$D x $\frac{1}{4}$
2	1	A2	BEAM	C.R.S.	$\frac{3}{8}$D x 28
1	2	A2	LEG	BR.	$\frac{3}{4}$D x 3

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°

MATERIAL

HEAT TREAT

PART NAME: ASSEMBLY **TRAMMEL POINTS**

NO. REQD. 1 | SCALE: FULL | SHEET 1 OF 3

USED ON | DWG. NO. 118 A1

ITEM	REQD.	DWG. NO.	PART NAME	MATL.	SIZE
1	2	A2	LEG	BR.	$\frac{3}{4}$D x 3
2	1	A2	BEAM	C.R.S.	$\frac{3}{8}$D x28
3	2	A3	BINDING NUT	BR.	$1\frac{1}{4}$D x $\frac{1}{4}$
4	2	A3	POINT LOCK SCR	BR.	$\frac{1}{2}$D x$\frac{5}{16}$
5	2	A3	DIVIDER POINT	DRILL ROD	$\frac{5}{16}$D x 3
5A	2	A3	CALIPER POINT	DRILL ROD	$\frac{5}{16}$D x 3

DO NOT SCALE THIS DRAWING

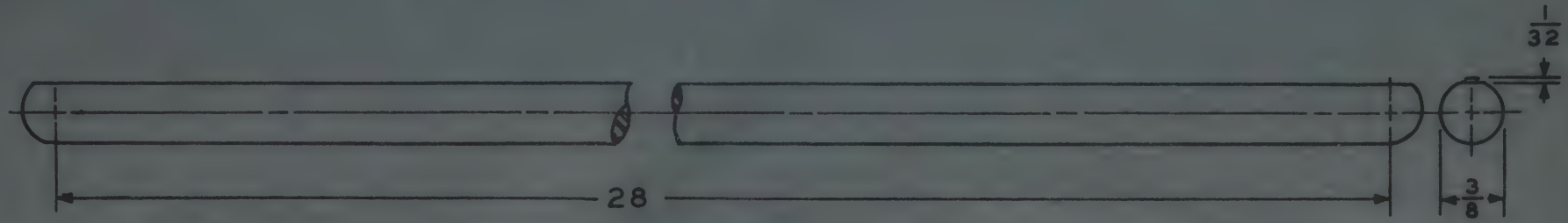
ASSEMBLY **TRAMMEL POINTS**

PART NAME	NO. REQ'D. 1	SCALE: FULL	SHEET 1 OF 3
USED ON		DWG. NO. 118 A1	

MATERIAL	HEAT TREAT

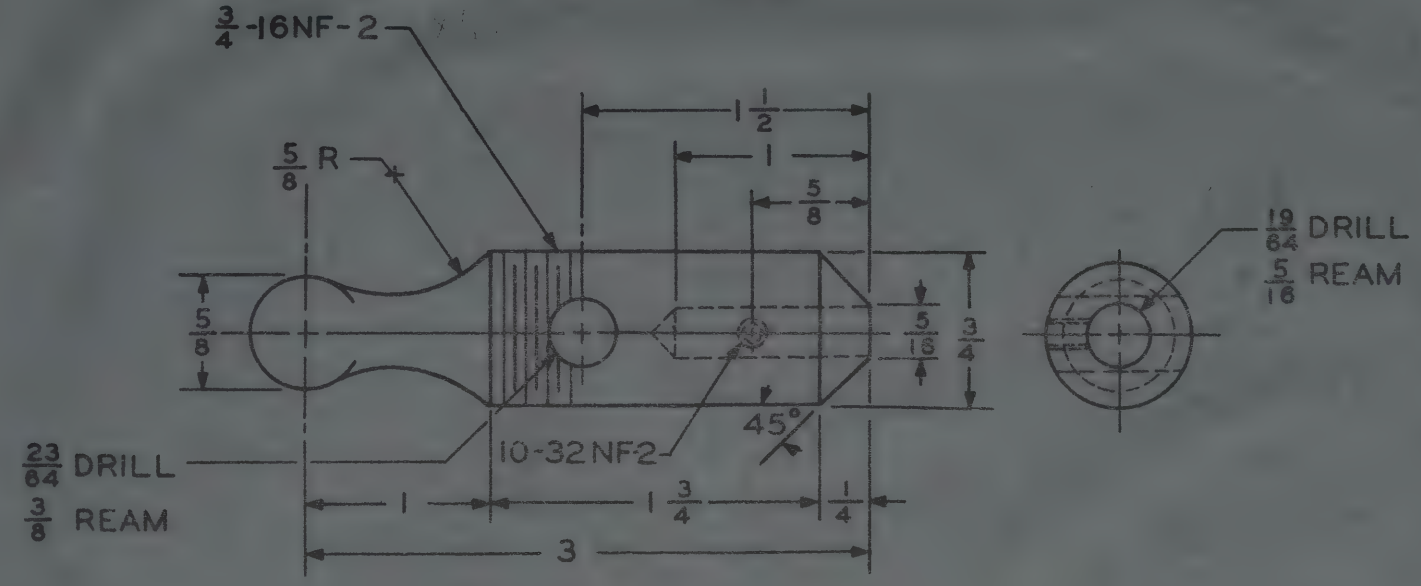
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED : TRUE CENTERS WITHIN ±.003 OF CENTER RATIOS LINEAR ±.003 ; ANGULAR ± 2°
DIMENSIONAL TOLERANCES : FRACTIONAL ± $\frac{1}{64}$; DECIMAL ±.005



(2) BEAM

C.R.S. 1 REQD.



(1) LEG

BRASS 2 REQD.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	NO. 1 & 2 TRAMMEL POINTS
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 2 OF 3
		USED ON 118 A1	DWG. NO. 118 A 2

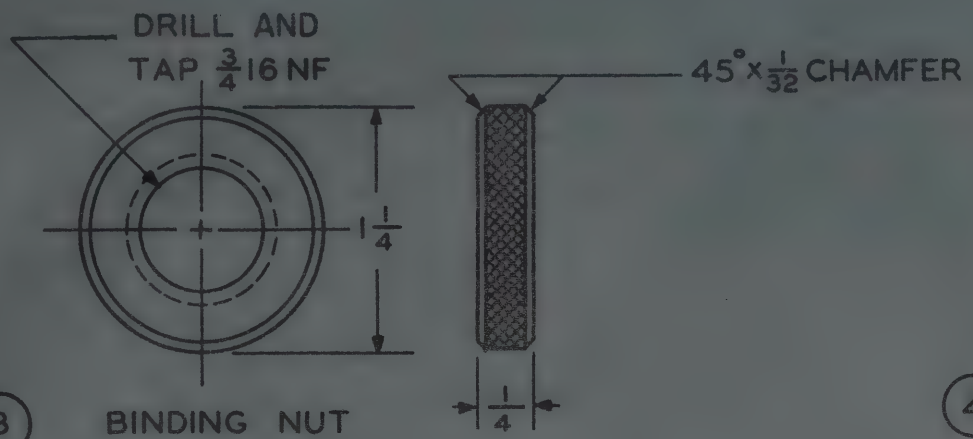
DO NOT SCALE THIS DRAWING

				MATERIAL	
				HEAT TREAT	
PART NO.	NAME	NO. REQD.	SCALE: FULL	SHEET 2 OF 3	
		USED ON 118 A1		DWG. NO. 118 A2	

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

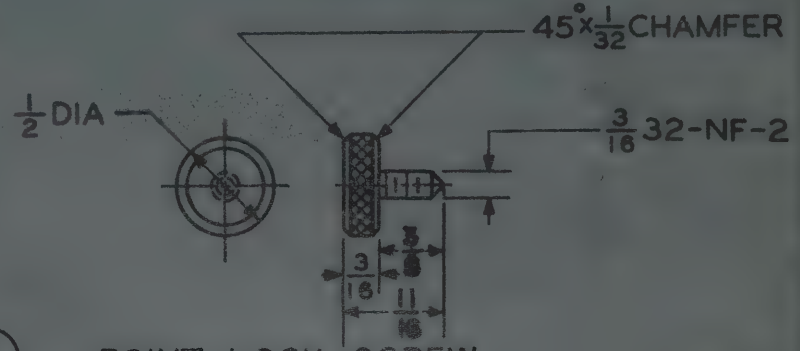
UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.005; ANGULAR ±2°

MED. KNURL



(3) BINDING NUT

BRASS 2 REQD.



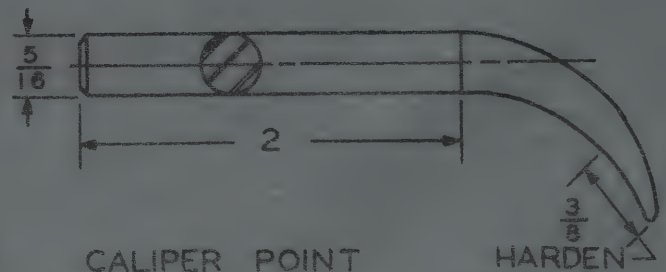
(4) POINT LOCK SCREW

BRASS 2 REQD.



(5) DIVIDER POINT

DRILL ROD 2 REQD.



(5A) CALIPER POINT

DRILL ROD 2 REQD.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	NO. 3, 4, 5 & 5A TRAMMEL POINTS
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL — SHEET 3 OF 3
		USED ON 118 A 1	DWG. NO. 118 A 3

MED. KNURL

45°x 1/32 CHAMFER

DRILL AND TAP 3/8-18 NF

3/8-32-NF-2

45°x 1/32 CHAMFER

1/2 DIA

5/16

3/8

11/16

(4) POINT LOCK SCREW — BRASS — 2 REQD.

1/4

1 1/4

(3) BINDING NUT — BRASS — 2 REQD.

3/8 HARDEN

S

L

5/16

(5) DIVIDER POINT — DRILL ROD — 2 REQD.

3/8 HARDEN

S

5/16

(6A) CALIPER POINT — DRILL ROD — 2 REQD.

DO NOT SCALE THIS DRAWING

MATERIAL		PART NO.	3, 4, 5 & 6A	
HEAT TREAT		NAME	TRAMMEL POINTS	
NO. REQD.	SCALE: FULL	SHEET 3 OF 3		
USED ON 118 A1		DWG. NO. 118 A3		

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED: TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR ±1°

TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY +.001

DIMENSIONAL TOLERANCES

FLY-CUTTING ADAPTOR

INTRODUCTORY INFORMATION:

The fly-cutting adaptor is used on a milling machine for rough and finished flat surfaces. The inserted high speed steel tool bits make this an efficient cutting tool.

STOCK:

Machine steel 3-1/8" dia. x 4" long.

SAFETY AND PRECAUTIONS:

1. Stop machine before measuring job.
2. Don't wear loose clothing or ties.
3. See that all safety guards are on machines.
4. Wear eye protection.
5. Observe all shop safety rules.

Fly-Cutting Adaptor

STOCK:

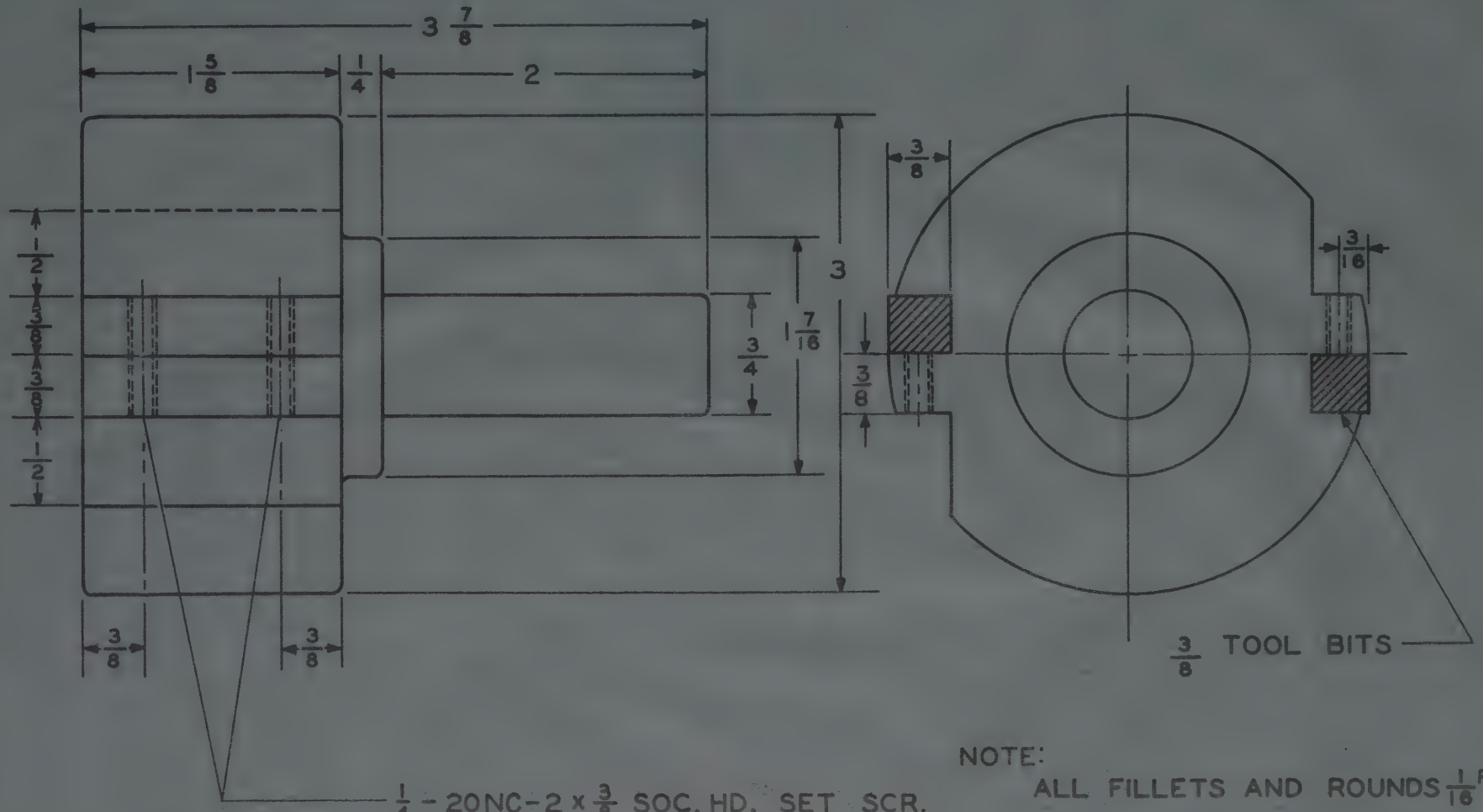
M. S.

TOOLS:

Combination square set	Center punch	Center drill
Layout dye	Hammer	10" Mill file
Scriber	13/64" Drill	Tap wrench
1" Micrometer	1/4" - 20 NC Tap	
3" Outside caliper	3/8" Wide mill cutter	

PROCEDURES OR STEPS:

1. Select 3-1/8" dia. x 4" long machine steel.
2. Chuck true in lathe chuck.
3. Face end and center drill.
4. Face other end to 4" length and center drill.
5. Turn shank to 3/4" dia. x 2" long.
6. Turn shoulder 1-7/16" dia. x 1/4" long.
7. Turn large 3" dia. x 1-5/8" long.
8. Round all edges to a 1/16" radius.
9. File and polish all over.
10. Cover with layout dye, layout for 3/8" square tool bits and screw clearance notches.
11. Place in mill dividing head, mill notches and 3/8" slots.
12. Layout for two 1/4" screw holes.
13. Drill two #7 screw holes.
14. Tap two 1/4" - 20 NC screw holes.
15. Inspect for sizes according to drawing.



NOTE:
ALL FILLETS AND ROUNDS $\frac{1}{16}^{R}$

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: M. S.	PART NAME: FLY-CUTTING ADAPTOR	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT:	NO. REQD. 1	SCALE: FULL / SHEET 1 OF 1
		USED ON	DWG. NO. 119 A 1

3 7/8
S
1/4
5/8
3/8
3/8
3/8
3/8
3
1 1/8
3/4
3/8
3/8
3/8
S
S
S
S
3/8 TOOL BITS
1/4 - 20 UNC-2 x 3/8 SOC. HD. SET SCR.
ALL FILLETS AND ROUNDS 1/8 R
NOTE:
DO NOT SCALE THIS DRAWING
FLY-CUTTING ADAPTOR
NAME
MATERIAL
M. S.
HEAT TREAT
USED ON
DWG NO. 1191 A1
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE
UNLESS OTHERWISE SPECIFIED :
THREE CENTERS OF HOLES WITHIN ±.001
100± ANGULAR: ±.03 DECIMAL: ±.005 FRACTIONAL: ±1/64

STANDARD LATHE MANDREL

INTRODUCTORY INFORMATION:

The lathe mandrel is a very valuable tool in the machine shop; it is used to turn, face and grind bushings, pulleys, collars and gear blanks true with the center hole.

STOCK:

Carbon tool steel

SAFETY AND PRECAUTIONS:

1. Use special center drill for recessing both ends of mandrel.
2. Always keep center holes clean from chips and dirt.
3. Use tail stock center lubricant when turning.
4. Do not twist lathe tail stock center off due to lack of lubrication.
5. Observe all shop safety rules.

Standard Lathe Mandrel

STOCK:

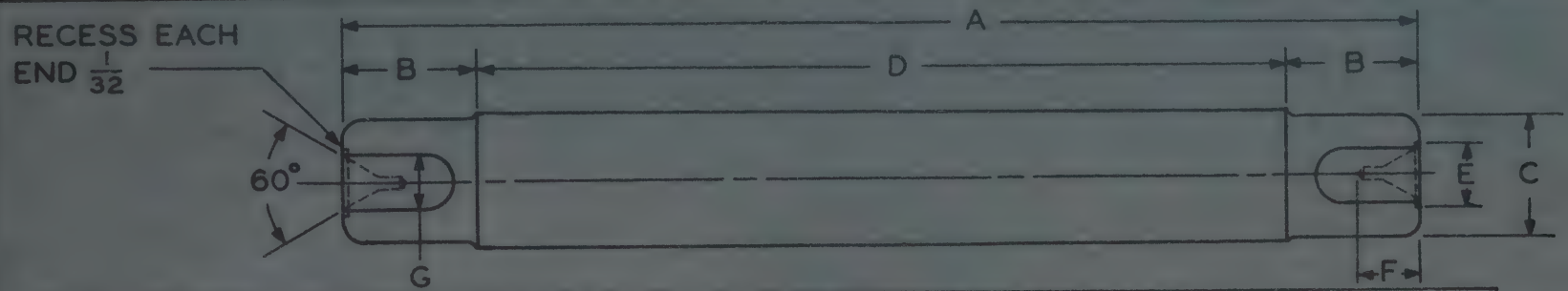
T. S.

TOOLS:

12" Steel rule
1" Micrometers
2" Micrometers
10" Mill file
Center drill (special)
3/4" End mill
Emery cloth
Brass head center
Loose emery and oil

PROCEDURES OR STEPS:

1. Saw off tool steel 1/8" larger in ida. and length.
2. True work in lathe chuck, face and center drill.
3. If special center drill is not available, bore E recess in end.
4. Turn opposite end, face to length and center drill.
5. Turn outside diameter, plus .025" for grinding.
6. Turn both ends to C diameter and B length.
7. Round both ends.
8. Place on mill index head, mill flat on ends at G.
9. Harden and draw temper.
10. Lap centers in line on lathe, with brass head center.
11. Grind to size as per drawing, note information on drawing.



NORMAL DIAMETER	TOTAL LENGTH	LENGTH OF ENDS	DIAMETER OF ENDS	LENGTH OF TAPER	DIAMETER OF C'S'K	DEPTH OF HOLE	WIDTH OF FLAT
	A	B	C	D	E	F	G
3/16	3 1/4	5/16	5/32	2 5/8	5/64	5/32	1/8
1/4	3 3/4	7/16	7/32	2 7/8	1/8	7/32	5/32
5/16	4	7/16	9/32	3 1/8	1/8	7/32	3/16
3/8	4 1/4	1/2	11/32	3 1/4	5/32	1/4	7/32
7/16	4 1/2	1/2	13/32	3 1/2	5/32	1/4	1/4
1/2	5	9/16	15/32	3 7/8	3/16	9/32	1/4
9/16	5 1/4	9/16	17/32	4 1/8	3/16	9/32	9/32
5/8	5 1/2	5/8	19/32	4 1/8	7/32	5/16	9/32
11/16	5 3/4	5/8	21/32	4 1/2	7/32	5/16	5/16
3/4	6	3/4	23/32	4 1/2	1/4	3/8	5/16
7/8	6 1/2	1 1/8	49/64	4 1/4	11/32	7/16	11/32
1	7	1 3/16	7/8	4 5/8	3/8	1/2	3/8
1 1/8	7 1/2	1 1/4	63/64	5	13/32	9/16	13/32
1 1/4	8	1 5/16	1 3/32	5 3/8	7/16	5/8	7/16
1 3/8	8 1/2	1 3/8	1 13/64	5 3/4	15/32	11/16	15/32
1 1/2	9	1 7/16	1 5/16	6 1/8	1/2	3/4	1/2

NOTE:
.006 TAPER PER FT. FROM LARGE END.

TURN .025 OVER-SIZE- HARDEN & GRIND TO SIZE. MANDRELS .0005 BELOW STANDARD AT SMALL END.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

MATERIAL	PART NAME	STANDARD LATHE MANDREL	
T. S.			
HEAT TREAT	NO. REQD. 1	SCALE: FULL	SHEET 1 OF 1
SEE NOTE ABOVE	USED ON		DWG. NO. 120 A 1

NORMAL DIAMETER	TOTAL LENGTH	LENGTH OF ENDS	DIAMETER OF ENDS	LENGTH OF TAPER	DIAMETER OF C'S,K	DEPTH OF HOLE	WIDTH OF FLAT
	A	B	C	D	E	F	C
3/16	1 3/4	1/2	3/32	2	2/64	2/32	1/8
1/4	3 3/4	1/2	5/32	2 1/8	1/8	1/32	2/32
5/16	4	1/2	5/32	3 1/8	1/8	1/32	3/32
3/8	4 1/4	1/2	11/64	3 1/4	2/32	1/32	1/16
7/16	4 1/4	1/2	13/64	3 1/8	2/32	1/32	1/16
1/2	5	1/2	13/64	4 1/8	2/32	1/32	1/16
9/16	5 1/4	1/2	15/64	4 1/8	2/32	1/32	1/16
5/8	5 1/2	1/2	15/64	4 1/8	2/32	1/32	1/16
11/16	5 3/4	1/2	15/64	4 1/8	2/32	1/32	1/16
3/4	6	1/2	15/64	4 1/8	2/32	1/32	1/16
13/16	6 1/4	1/2	15/64	4 1/8	2/32	1/32	1/16
7/8	6 1/2	1/2	15/64	4 1/8	2/32	1/32	1/16
15/16	6 3/4	1/2	15/64	4 1/8	2/32	1/32	1/16
1	7	1/2	15/64	4 1/8	2/32	1/32	1/16
1 1/16	7 1/4	1/2	15/64	4 1/8	2/32	1/32	1/16
1 1/8	7 1/2	1/2	15/64	4 1/8	2/32	1/32	1/16
1 3/16	7 3/4	1/2	15/64	4 1/8	2/32	1/32	1/16
1 1/4	8	1/2	15/64	4 1/8	2/32	1/32	1/16
1 5/16	8 1/4	1/2	15/64	4 1/8	2/32	1/32	1/16
1 3/8	8 1/2	1/2	15/64	4 1/8	2/32	1/32	1/16
1 7/16	8 3/4	1/2	15/64	4 1/8	2/32	1/32	1/16
1 1/2	9	1/2	15/64	4 1/8	2/32	1/32	1/16

NOTE:
.005 TAPER PER FT. FROM LARGE END.

TURN .025 OVER-SIZE - HARDEN & GRIND TO SIZE. .0005 MANDRELS STAND-BELOW AT SMALL ARD END.

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

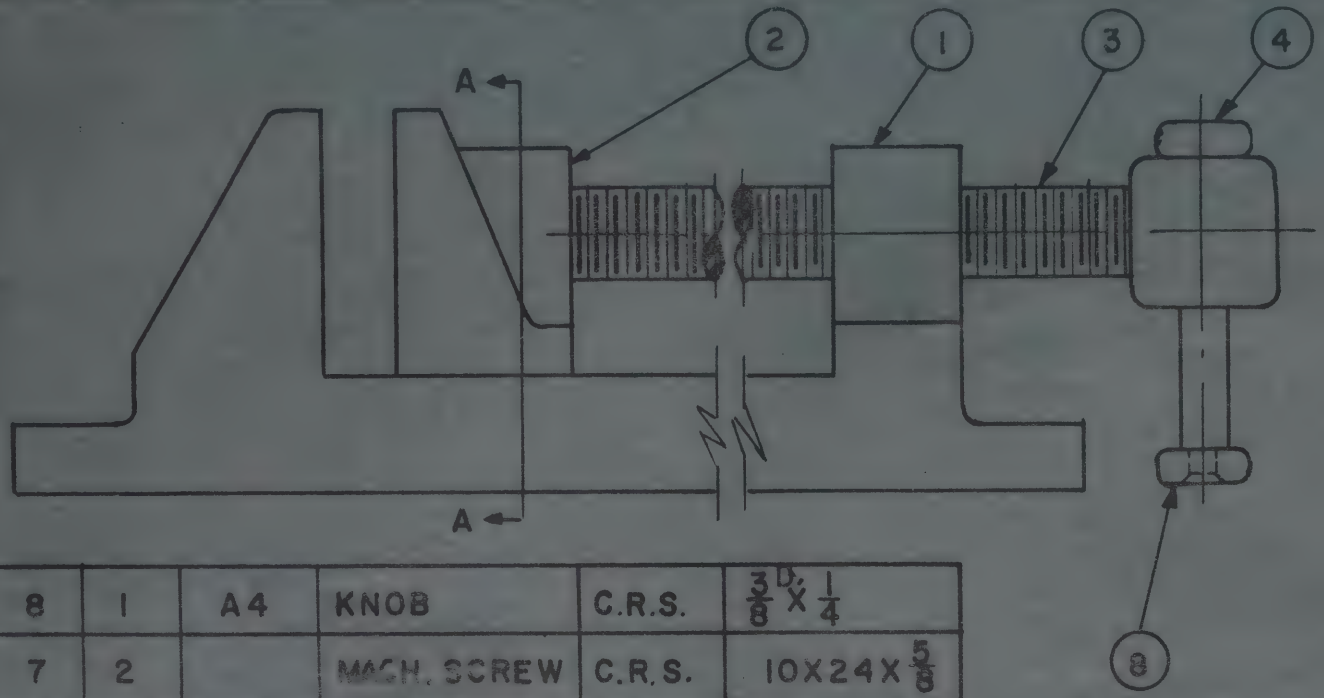
STANDARD LATHE MANDREL

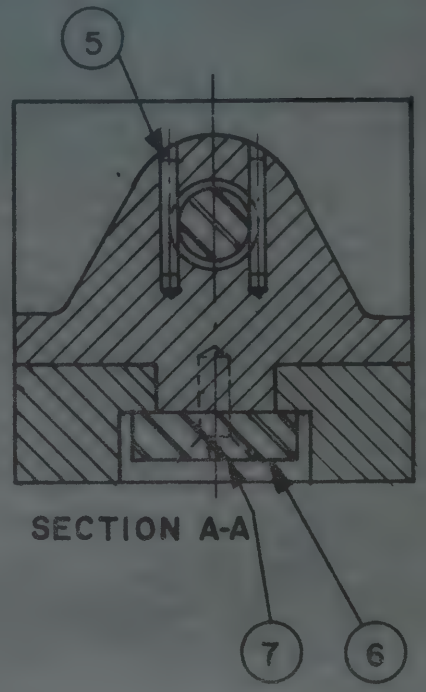
MATERIAL: T. S.
HEAT TREAT: SEE NOTE ABOVE
PART NAME
SCALE: FULL
SHEET 1 OF 1
NO. REQD. 1
DWG. NO. ISOA 1
USED ON

DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°

Job - 121
2" DRILL PRESS VISE
(Job sheets not included)





SECTION A-A

ITEM	REQD.	DWG. NO	PART NAME	MAT'L.	SIZE
8	1	A4	KNOB	C.R.S.	$\frac{3}{8}$ D. X $\frac{1}{4}$
7	2		MACH. SCREW	C.R.S.	10X24X$\frac{5}{8}$
6	1	A3	PLATE	C.R.S.	$\frac{1}{4}$ X $\frac{7}{8}$ X $1\frac{1}{2}$
5	2		PIN	C.R.S.	$\frac{1}{8}$ D. X $\frac{5}{8}$
4	1	A4	PIN HANDLE	C.R.S.	$\frac{3}{8}$ D. X 2
3	1	A4	SCREW	C.R.S.	$\frac{3}{4}$ D. X $5\frac{5}{8}$
2	1	A3	MOVABLE JAW	C.I.	$\frac{15}{16}$ X $1\frac{5}{8}$ X $2\frac{1}{8}$
1	1	A2	BASE	C.I.	2 X $2\frac{1}{8}$ X $7\frac{1}{4}$

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES. FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.010; ANGULAR 2°

MATERIAL

HEAT TREAT

PART NAME: DRILL PRESS VISE 2

NO. REQD. | SCALE FULL | SHEET 1 OF 4

USED ON | DWG. NO. 121A1

ITEM	REQ'D.	DWG. NO.	PART NAME	MAT'L.	SIZE
8	1	A4	KNOB	C.R.S.	$\frac{3}{8}$ D. x $\frac{1}{4}$
7	2		MACH. SCREW	C.R.S.	10X24 x $\frac{3}{8}$
6	1	A3	PLATE	C.R.S.	$\frac{1}{4}$ x $\frac{7}{8}$ x 1$\frac{1}{2}$
5	2		PIN	C.R.S.	$\frac{1}{8}$ D. x $\frac{5}{8}$
4	1	A4	PIN HANDLE	C.R.S.	$\frac{3}{8}$ D. x S
3	1	A4	SCREW	C.R.S.	$\frac{3}{4}$ D. x $\frac{5}{8}$
2	1	A3	MOVABLE JAW	C.I.	$\frac{15}{16}$ x 1$\frac{5}{8}$ x 2$\frac{1}{8}$
1	1	A2	BASE	C.I.	2 x 4$\frac{1}{8}$ x $\frac{1}{4}$

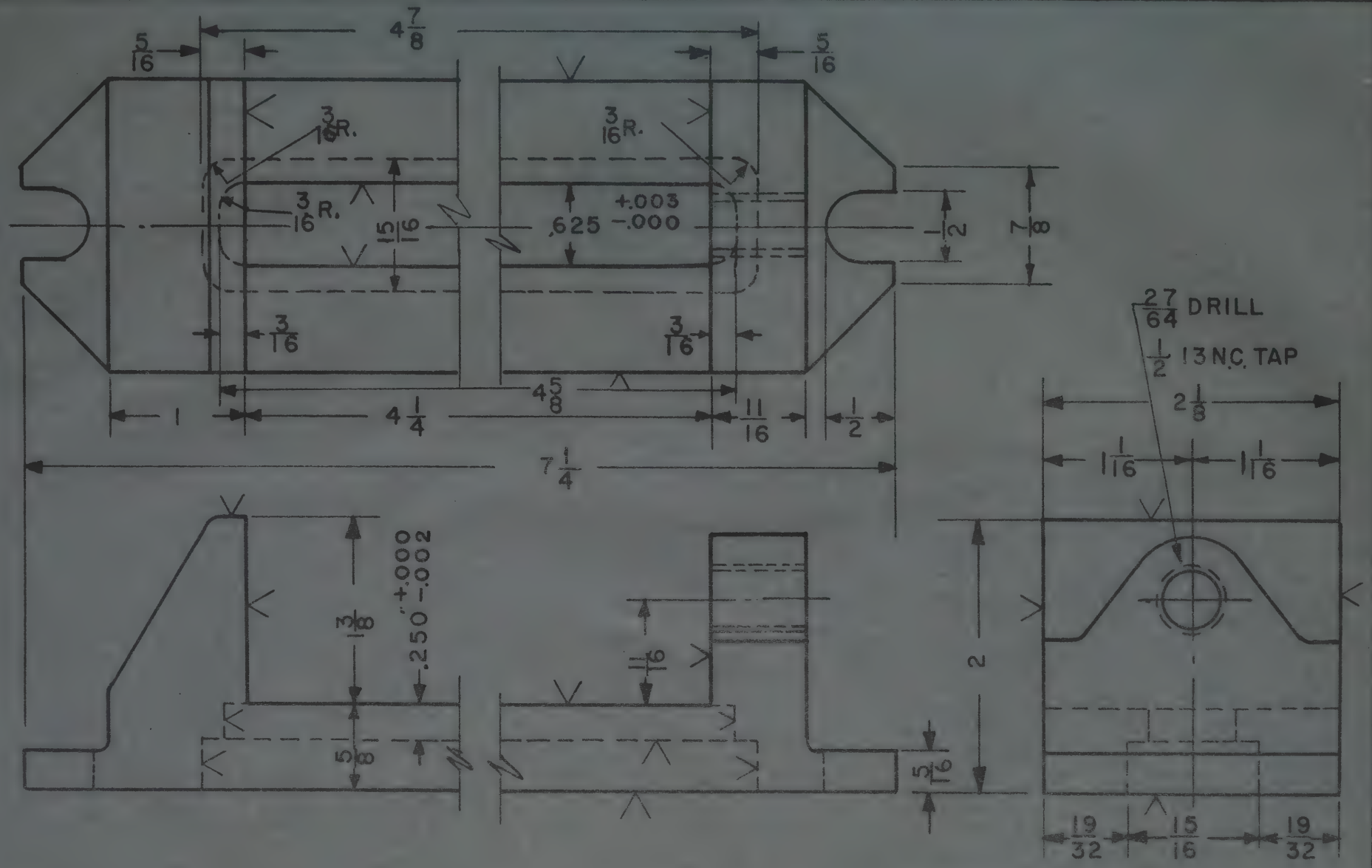
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES : FRACTIONAL ±$\frac{1}{64}$; DECIMAL ±.003 ; ANGULAR 2°

MATERIAL		HEAT TREAT		NO. REQD.	SCALE FULL	SHEET 1 OF 4
	PART NAME		USED ON		DWG. NO.	

DO NOT SCALE THIS DRAWING

DRILL PRESS VISE 2



DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.I.	PART NAME: ① BASE	
		DRILL PRESS VISE 2	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 2 OF 4
		USED ON 121A1	DWG. NO. 121A2

DIMENSIONS ARE IN INCHES. TOLERANCES: FRACTIONAL ±1/64; .XX ±.03; ANGULAR ±2°.

INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1982.

REMOVE BURRS AND SHARP EDGES.

DO NOT SCALE THIS DRAWING

MATERIAL	C1	HEAT TREAT	
FINISH			
NEXT ASSY		USED ON	
APPLICATION		DO NOT SCALE	
NAME	DRILL PRESS BASE ①	SCALE: FULL	SHEET 1 OF 4
DRAWN			
CHECKED			
ENGR APPR.			
MFG APPR.			
Q.A.			
COMMENTS:			

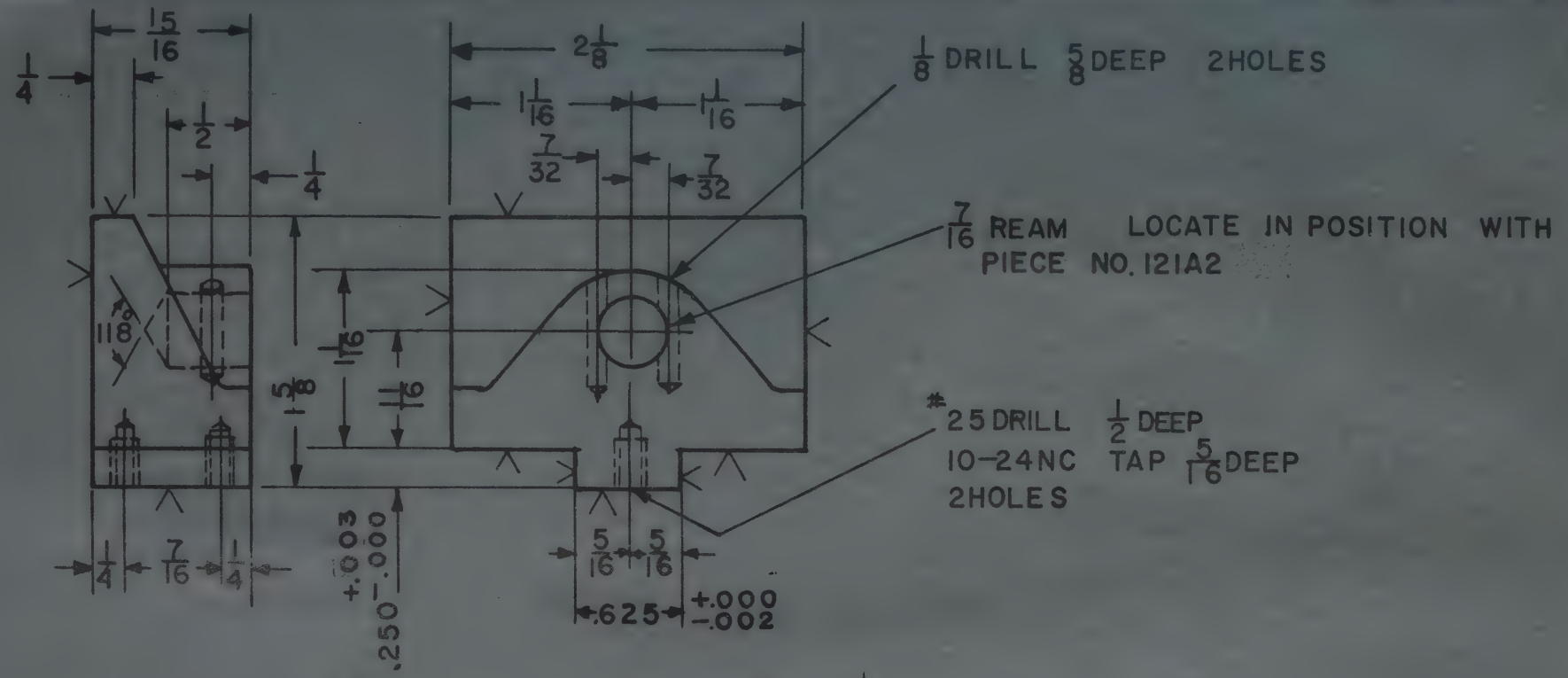
ENGRAVE MOTACRADE JARTSUONI ONA EDART OIHO EHT

NOTE: MACHINE SURFACES WHERE THIS SYMBOL APPEARS

NOTE: CHECK ALL DIMENSIONS BEFORE MACHINING

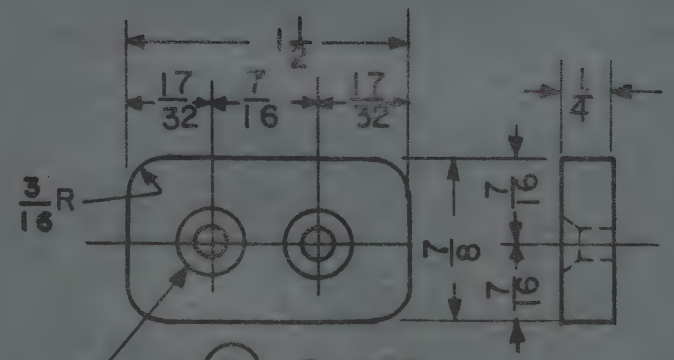
NOTE: REMOVE BURRS AND SHARP EDGES

DRILL
13 HOLES
TAP



(2) MOVABLE JAW

C.I. 1 REQ'D.



(6) PLATE

C.R.S 1 REQD.

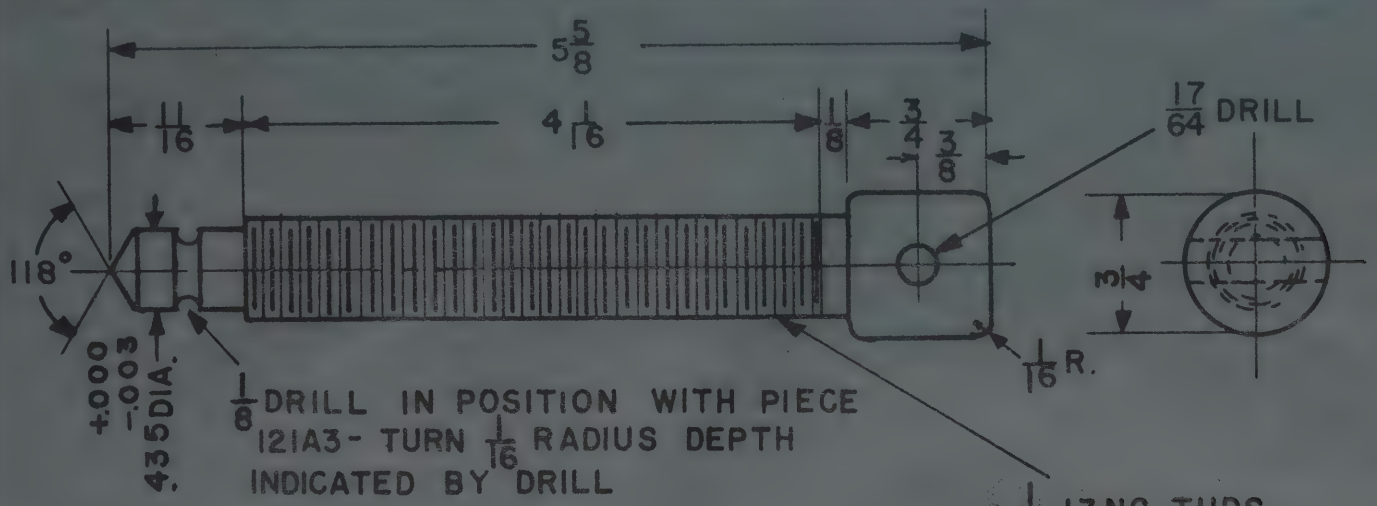
F.A.O.

#9 DRILL & C'SINK FOR
2-10-24 FLAT HD. MACH. SCREWS

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL	PART NAME	(2) (7)
			DRILL PRESS VISE 2
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES, FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 3 OF 4
		USED ON 121A1	DWG. NO. 121A3

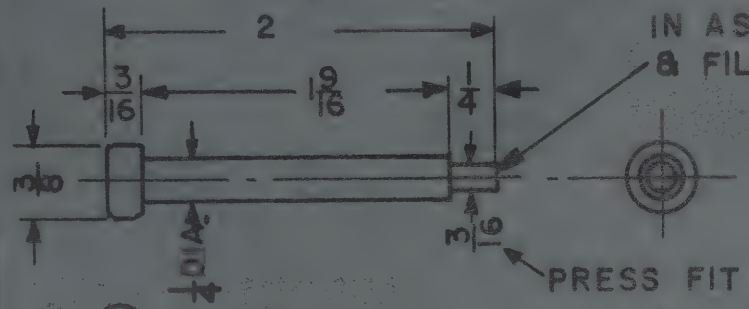
DRILL AND DEEP SHOLES
WITH
LOCATE IN POSITION
BEAM
PIECE ON
SAISI.NO
DEEP
TAP
SHOLES
SHOLES
MOVABLE JAW
#5 DRILL & C'SINK HD. FLAT AS-10-24 SCREWS FOR
PLATE
C.R.S
1 REQD.
1 REQD.
DO NOT SCALE THIS DRAWING
MATERIAL
HEAT TREAT
FINISH
NAME
DRAWN
CHECKED
ENGR APPROVED
MFG APPROVED
DRILL PRESS V SIS-2
SAISI NO
DWG. NO.
SIZE
SCALE
SHEET 1 OF 1
DIMENSIONS TOLERANCES: FRACTIONAL ±1/64, DECIMAL .005, ANGULAR ±1°
MACH. SURFACES 125 MICRO-INCH
BREAK CORNERS TO .005 MAX. UNLESS OTHERWISE SPECIFIED
THE OHIO INDUSTRIAL EDUCATION SERVICE



③ SCREW

C.R.S. 1 REQD.

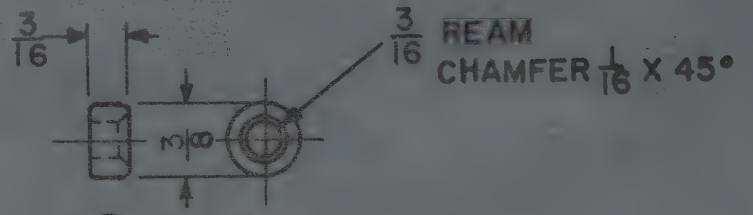
F.A.O.



④ PIN HANDLE

C, R, S. 1 REQ D.

F. A. O.



⑧ KNOB

C.R.S. 1 REQ'D

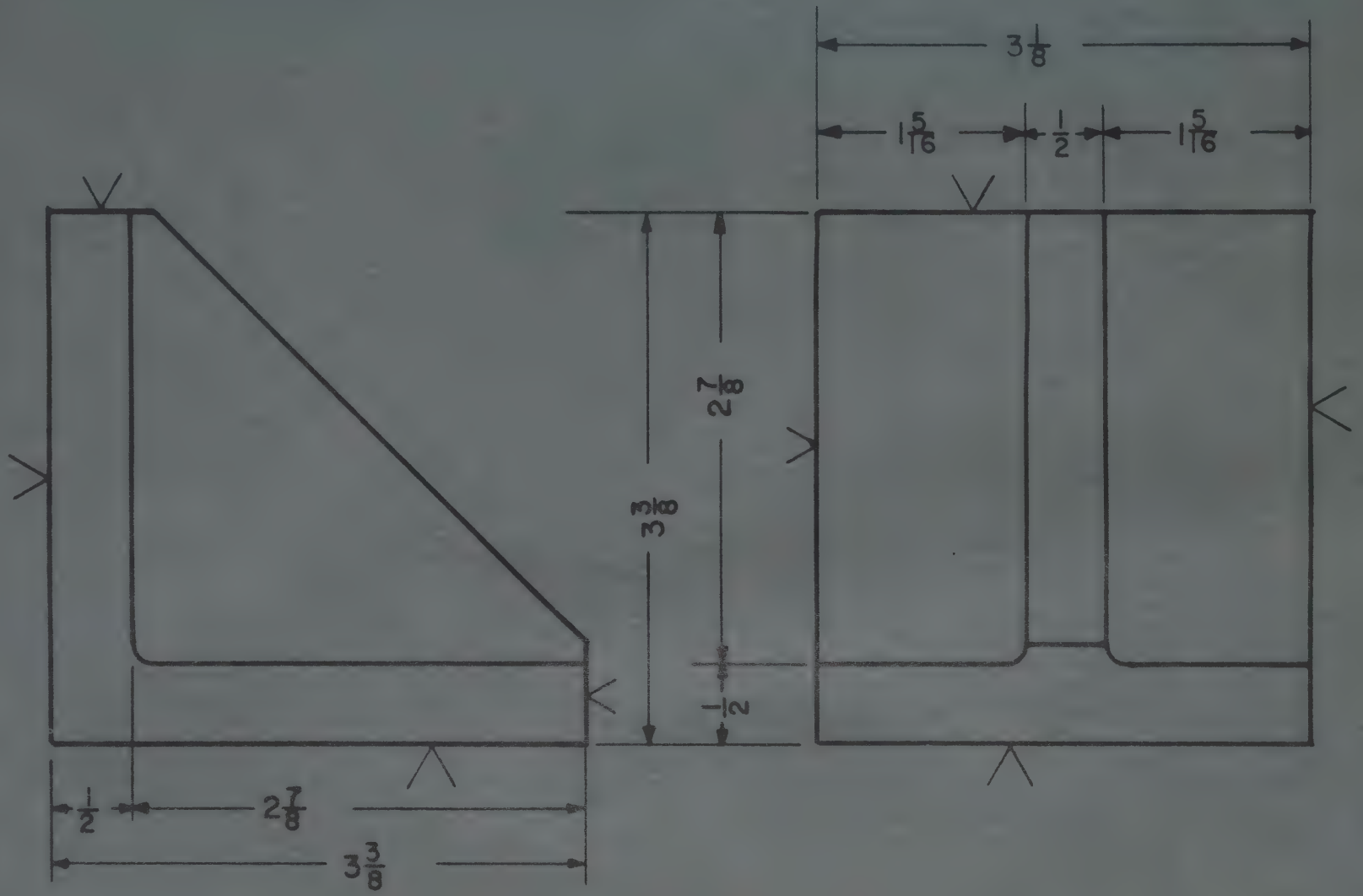
F.A.O.

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.R.S.	PART NAME: ③ ④ ⑧ DRILL PRESS VISE 2	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE, CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT:	NO. REQD.	SCALE: FULL / SHEET 4 OF 4
		USED ON 12IA1	DWG. NO. 12IA4

#17 DRILL
118°
DRILL IN POSITION WITH PIECE INDICATED BY DRILL
1/8 ISIAS- TURN 1/8 RADIUS DEPTH
1/4-13NC. THDS.
NOTE- THREADING TOOL WILL CUT #3SDIA. (SLIGHTLY) WHEN CUTTING THREAD
③ SCREW
C.R.S. 1 REQ'D.
F.A.O.
⑧ KNOB
C.R.S. 1 REQ'D.
F.A.O.
IN ASSEMBLY WITH ③ & ⑧ PEEN
& FILE
PRESS FIT IN ⑧
④ PIN HANDLE
C.R.S. 1 REQ'D.
F.A.O.
BREAK CHAMFER 1/16 X 45°
DO NOT SCALE THIS DRAWING
THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE
UNLESS OTHERWISE SPECIFIED:
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°
MATERIAL
HEAT TREAT
NO. REQD.
USED ON ISIAI
PART NAME
DRILL PRESS VISE S
SCALE: FULL
SHEET 4 OF 4
DWG. NO. ISIA 4

Job - 122
3-3/8" ANGLE PLATE
(Job sheets not included)



DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C.I.	PART NAME: ANGLE PLATE	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES. FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: FULL / SHEET 1 OF 1
		USED ON	DWG. NO. 122A

DIMENSIONS TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.005; ANGULAR ±1°
TURN CENTERS WITHIN .010 TO CENTER LINE; CONCENTRICITY TOO!
UNLESS OTHERWISE SPECIFIED:

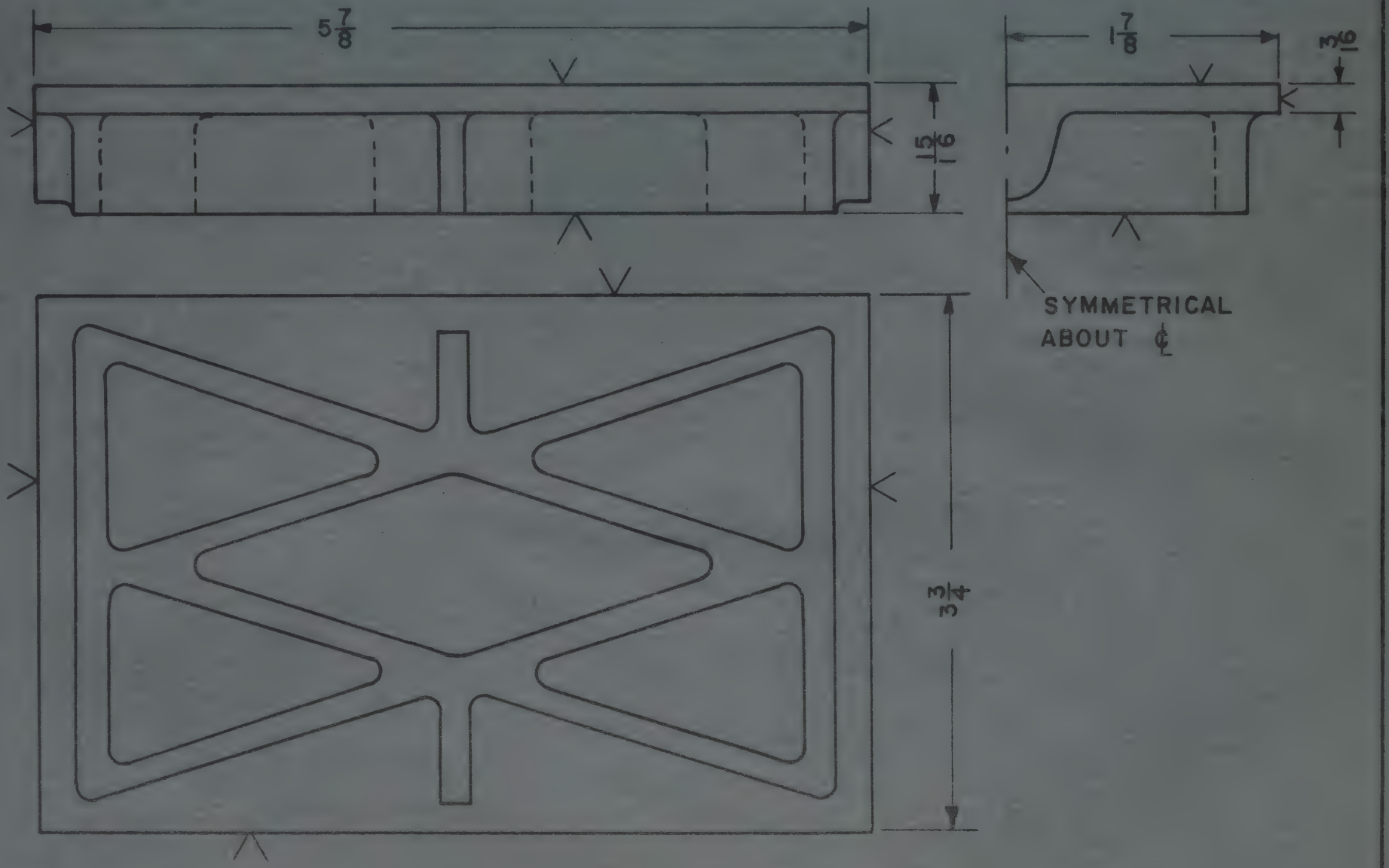
THE OHIO STATE UNIVERSITY ENGINEERING SERVICE

NEXT ASSY	MATERIAL	USED ON	DWG. NO. 12321
C.I.		NO NEXT USED	
FINISH	PART	SCALE: FULL	SHEET 1 OF 1

DO NOT SCALE THIS DRAWING

STATE ENGINE

Job - 123
3-3/4" x 5-3/4" SURFACE PLATE
(Job sheets not included)



DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C. I.	PART NAME: SURFACE PLATE	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT:	NO. REQD.	SCALE: FULL / SHEET 1 OF 1
		USED ON	DWG. NO. 123A1

THE OHIO INDUSTRIAL EDUCATION LABORATORY

			DWG. NO.
		SCALE: FULL	SHEET 1 OF 1

NAME	PART NO.	NO. REQD.	MATERIAL

DO NOT SCALE THIS DRAWING

DIMENSIONAL TOLERANCES: FRACTIONAL ± 1/64; DECIMAL ± .005; ANGULAR ± 2°

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS GIVEN WITHIN TOLERANCES OF ± .003 MINUTE ARE TRUE CENTERS

SURFACE FINISH

STATE SURFACE

SYMMETRICAL ABOUT ℄

$\frac{3}{4}$

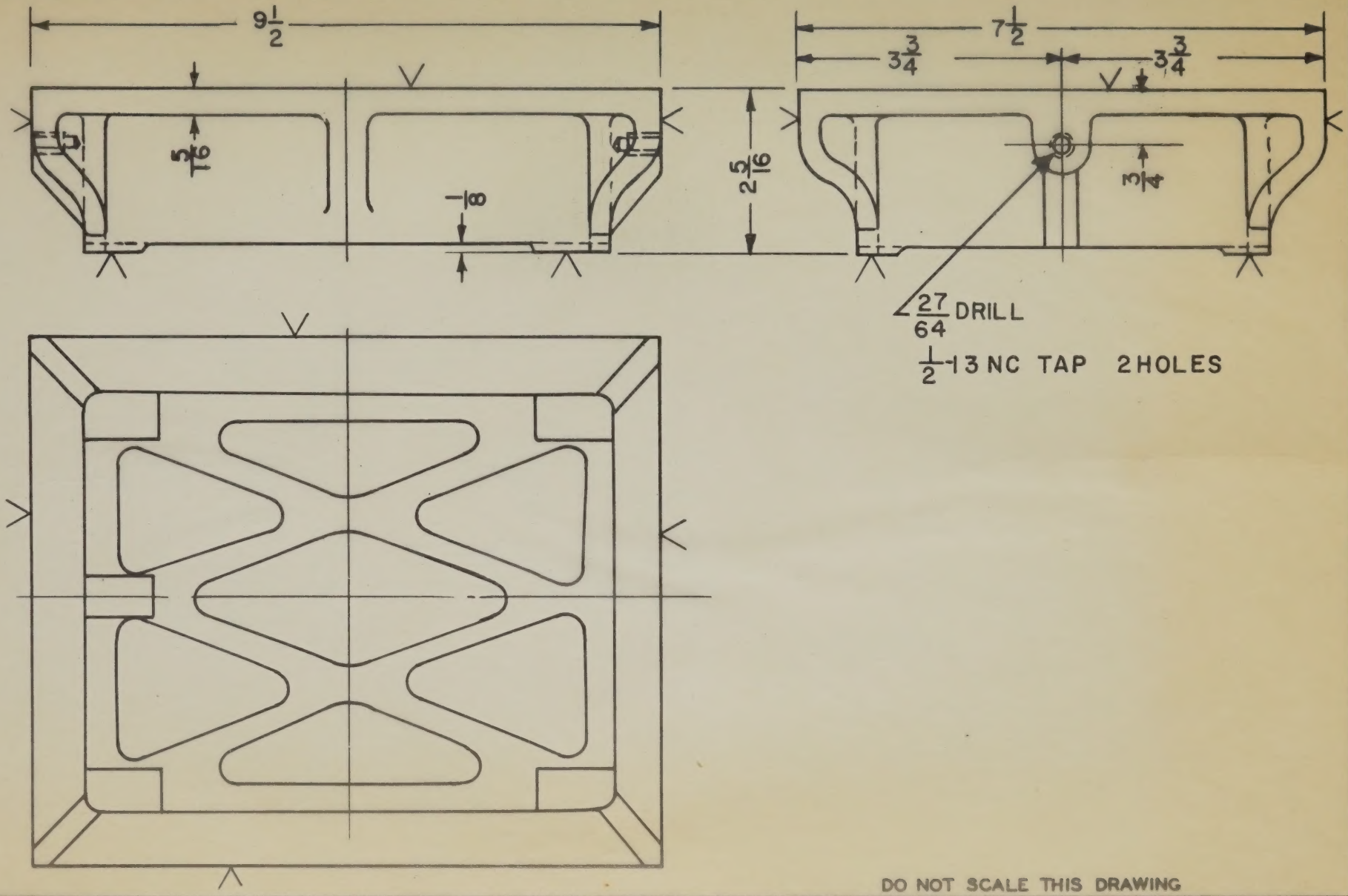
$\frac{1}{8}$

$\frac{1}{8}$

$\frac{1}{2}$

$\frac{5}{8}$

Job - 124
8" x 10" SURFACE PLATE
(Job sheets not included)



DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE	MATERIAL: C I	PART NAME: SURFACE PLATE	
UNLESS OTHERWISE SPECIFIED: TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001 DIMENSIONAL TOLERANCES. FRACTIONAL ±1/64; DECIMAL ±.003; ANGULAR 2°	HEAT TREAT	NO. REQD.	SCALE: HALF / SHEET 1 OF 1
		USED ON	DWG. NO. 124A1

DO NOT SCALE THIS DRAWING

THE OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

MATERIAL	PART NAME	SURFACE PLATE
C 1		
HEAT TREAT	NO. REQD.	SCALE: HALF SHEET 1 OF 1
USED ON		DWG. NO. 1524A

UNLESS OTHERWISE SPECIFIED :
TRUE CENTERS WITHIN ±.003 OF CENTER LINE. CONCENTRICITY ±.001
DIMENSIONAL TOLERANCES: FRACTIONAL ±1/64; DECIMAL ±.03; ANGULAR 2°

3 0112 077799457